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JPRS 82241

16 November 1982

# Worldwide Report

ENVIRONMENTAL QUALITY

No. 377

CHINA ADDRESSES ENVIRONMENTAL ISSUES -- III

19981203 128



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## INCORPORATION OF ENVIRONMENTAL RIGHTS IN LAWS URGED

Beijing ZHONGGUO SHEHUI KEXUE [SOCIAL SCIENCES IN CHINA] in Chinese No 3, 1982  
pp 29-39

[Article by Cai Shouqiu\* [5591 1343 4428]: "Preliminary Investigation Into Environmental Rights"]

[Text] In the wake of the modern development of production and the daily more serious environmental pollution, the human ecosystem has received a serious threat; the people of all countries are demanding, ever more insistently, the formulation and perfection of environmental laws in order to protect the environment and prevent further pollution; consequently, the study of environmental rights has been brought to the fore. The concept of environmental rights includes both the right of the nation and its legal entities and citizens to use and enjoy natural environmental conditions, and their duty to keep the natural environment from becoming polluted further. This article, through a comparison of the relevant regulations contained in the laws of various countries, makes a preliminary investigation into the general concept and specific meanings of environmental rights as well as the question of laws relating to them. The author considers that although China's constitution also contains some material on environmental protection, nevertheless we should do more in our laws to emphasize and broaden the concept of environmental rights. This is an important guarantee for doing a good job in our country's work of environmental protection.

Due to the increase of environmental pollution, a whole series of new social problems have been created; hence, the modern social sciences have been presented with many new topics for study, of which the question of environmental rights is one. Based on the actual current situation of China's environmental protection work and the demands of the broad masses, and in the course of stepping up the establishment of a legal system determining the areas to be covered by environmental protection, solving the question of environmental rights in both its theoretical and practical aspects has already become a problem worthy of attention. This article investigates the problem in several aspects, as outlined below, in the hope of arousing comrades to study the problem more intently.

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## The Proposition of Environmental Rights

Environmental rights is a new cause that has been brought before us by the development of the life and production of society; it is the product of the continuous worsening of the human environment as well as the continuous strengthening of the work of protecting the human environment. The question of the environment in human society has undergone a process of development, and in different historical periods the question of the environment has had a different nature and different characteristics, and this fact is reflected in the different ways in which it has been manifested in law. During the very long period prior to the Industrial Revolution, due to the low level of human productive forces, from the point of view of the situation as a whole the influence of human activity on the environment did not constitute a serious attack on the ability of the environment to purify itself. During this period, the question of the environment was manifested principally in problems relating to the utilization of natural resources, or in areas that had considerable influence on people's lives; in law some scattered articles appeared which had the effect of protecting a part of the environment. During the period between the Industrial Revolution and World War II, in the wake of the appearance of capitalist heavy industry, the level of productive force was continuously raised, and the influence of human activity upon the environment became greater and greater. The question of the environment during this period consisted mainly of concern over point-source pollution and area pollution by the three industrial wastes, which was reflected in law by the appearance of some single-article environmental protection laws and regulations or environmental protection laws of a purely local nature. During these two stages, neither articles of law nor single-article laws and regulations clearly proposed the general concept of environmental rights, and in the fundamental laws and constitutions of the various countries, there was still less any clear formulation of environmental rights. After World War II, and in particular during the sixties and seventies, industrial and agricultural production grew by leaps and bounds, bringing about the danger of the pollution of large areas, or even of the entire world, and seriously threatening the human ecological balance, the safety of mankind itself, and the economic development of society, thus creating a great number of disputes on the subject of environmental pollution. According to some estimates and statistics, there is a tendency for the total quantity of pollutants to double every 14 or 15 years. In the Soviet Union, losses due to water pollution each year amount to over 6 billion rubles. In the United States, total losses through death, disease, and material losses caused by air pollution alone amounted to \$25 billion; in the United States in 1972, 80 million people, or 40 percent of the population, were harmfully affected by noise pollution, and an additional 40 million face the danger of hearing impairment. In Japan, in 1970 alone the number of cases of litigation involving environmental pollution harmful to the public welfare reached 60,000. For this reason, some people in Western countries call our present age the "Age of Environmental Crisis," and refer to the questions of environmental pollution and the ecological balance as "ecological politics." At this stage, the people's cry for the prevention of pollution and environmental protection is louder than at any other period in history, with the result that it has led to the formation of the newly independent legal department of environmental law, and it is also during this stage that the concept of environmental rights has been proposed.

Faced with the harsh reality of environmental pollution, people gradually awakened to the realization that the natural environment that originally gave benefits to people without ever asking anything in return is now capable of bringing along a good many troubling, disquieting elements as well, and that heaven-given rights that people had considered as coming with life itself, such as the right to breathe clean air, are now capable of being invisibly harmed and expropriated. As the "Human Environment Manifesto"<sup>1</sup> points out: "Human beings on this planet, throughout the long course of their evolution, have had a great many hardships and difficulties; only the rapid progress of science and technology and the use of countless methods and the attainment of forces on a historically unprecedented scale have enabled human beings to reach the stage where they can change their environment. The question of the environment in its original, natural state versus the environment as altered by man is exceedingly important for the right of human beings to enjoy well-being, and for other basic human rights--even the right of existence." For their own welfare, people in great numbers have called on those who discharge pollutants into the environment to respect others' right to life and to prevent the quality of the environment from being harmed by pollution. The polluters, however, proceeding from the traditional viewpoint, consider that discharging pollutants into the waterways, atmosphere, and open country that are not owned by any individual is not to be considered illegal or as impinging on anyone's rights; that engaging in economic activity, and making a profit therefrom, is their right as determined by law; and that discharging pollutants is a necessary condition for exercising that right. In this way, two contradictory and conflicting views concerning social rights are produced. The victims of pollution want to seek redress through some legal measure, which would have the greatest coercive force. However, traditional constitutions and laws, though they have formulated a great number of fundamental rights, have nevertheless still not formulated people's environmental rights, and this places the law in a weak, powerless position with respect to the polluters, and also in a condition of being unable to help the victims of pollution. For example, in 1960 a doctor in West Germany brought a case before Europe's Human Rights Commission to the effect that "discharging atomic wastes into the North Sea is a violation of human rights." However, the commission, on the grounds that the European Human Rights Treaty did not have any stipulation that guaranteed the cleanliness and healthiness of this environment, threw out his case. Since then, at the European Environmental Protection Conference, the European Environmental Cabinet Minister's Conference, and other European conferences, a motion to add environmental rights to the presently existing list of human rights in the European Human Rights Treaty, has been proposed many times, but it has never passed. This circumstance has aroused the indignation and censure of a great many people. For example, the American scholar [Rachel] Carson, who some people abroad consider to have launched the modern ecological era, laments in her 1962 book "The Silent Spring": "The present is also the age of industrial rule; in industry, it is difficult for the right to make money at any cost to be condemned"; "If one says that the Bill of Rights makes no mention of the right of citizens to a guarantee that they will escape the danger of being strewn with poisonous chemicals by private

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1. This article's sections on the "Human Environment Manifesto" were translated from the "Six Laws on the Environment" published in Japan in 1979.

individuals or public organizations, that is really only because our predecessors, due to limitations in their wisdom and foresight, had no way of imagining such problems." The "White Paper on Human Rights" published by the Federation of Japanese Lawyers in 1967 cried out loudly and urgently that "Public harm violates human rights." Afterward, people in great numbers strongly demanded a clarification, through law, of the rights to be enjoyed by the state, the collective, and the individual in utilizing natural environmental conditions, as well as the duties they must fulfill to protect that environment. In this way, environmental rights mounted the social stage known as the "age of environmental crisis." By the end of the sixties, under the powerful impetus provided by public opinion, environmental rights all at once became the central topic of study and discussion by environmental protection departments and legal departments; theoretical study and legislative work relating to environmental rights was also greatly developed, manifesting itself primarily in two areas:

First, in the international area, some international conferences on environmental protection one after the other passed manifestoes of principle on the subject of environmental rights, and some academic conferences investigated deeply and broadly theories on environmental rights and exchanged their results. For example at the International Conference on Public Harm convened in Tokyo in March 1970, the fifth item (relating to environmental rights) in the "Tokyo Resolutions" passed by the conference raised the following request: "Of particular importance is our request that the environmental rights, to be enjoyed by all people, of not being harmed by factors injurious to health or well-being, and the right of the present generation to leave to their descendants an inheritance consisting of natural resources filled with natural beauty, be made basic principles of legal rights and defined as part of the legal system. In the principles of the "Human Environment Manifesto" passed by the UN Human Environmental Conference convened in June 1972, it is clearly proclaimed: "Since people, in an environment that supports the maintenance of dignity and well-being, enjoy freedom, equality, and rich conditions for life, they have also assumed the serious responsibility of protecting and improving that environment for present and future generations." Hence, the proposition of environmental rights was brought up in such a way that both the rights and duties of environmental protection appeared at the same time. At the International Scientific Conference on the Human Environment convened in Tokyo in November 1975, at the conference on law, the central topic of discussion was "human rights with respect to the environment"; the legal experts coming from the various countries engaged in an academic exchange on the question of environmental rights, and the magazine RESEARCH ON ENVIRONMENTAL LAW edited by the Japanese legal profession's Association for the Study of Problems Related to the Human Environment published a special edition to present the results.

Second, in some countries where the question of the environment was prominent, theoretical study and legislative work relating to environmental rights achieved a relatively strong development. In Japan, specialized societies for the study of environmental rights, such as the Environmental Rights Society of the Osaka Lawyers' Association, appeared. Due to the fact that the concept of environmental rights had already been proposed in law and had aroused the attention of Japanese from all walks of life, the preface to the "Tokyo City Public Harm Prevention Regulations" formulated in 1969 emphasized that: "All residents of the city have the right to a healthy, safe and comfortable life, and these



rights cannot, because of public harm, be indiscriminately encroached upon." Following this, the "Tokyo City Government Public Harm Prevention Regulations" formulated in 1971 and the "Kawasaki City Public Harm Prevention Regulations" formulated in 1972 in turn adopted the same stand on environmental rights. In the United States, discussions on the general concept of environmental rights, its constitutional basis, and other theoretical legal questions relating thereto sprang up in 1969. The establishment of the U.S. Environmental Law Institute, and the theory of public trust proposed by University of Michigan Professor Sachs [Sa-ke-si], provided impetus to the study of environmental rights in the United States. In legislation, the first article of the U.S. "National Environmental Policy Law" (passed in 1969 and later revised) made a detailed formulation of the rights and duties of the state and its citizens with regard to the protection of the environment, and the third clause of this article emphasizes that: "The Congress considers that everyone should enjoy a healthy environment and that, at the same time, everyone also has the responsibility to make a contribution to preserving and improving that environment." The appearance of the concept of environmental rights in certain laws and regulations dealing with environmental protection gradually influenced the nation's fundamental, great law--the constitution. In Switzerland, in June 1971, the content of the seventh item in the newly established Article 24 of the Swiss constitution said: "The Federation should adopt legislative measures to protect people and their natural environment from harmful or unpleasant encroachments, and the Federation especially should struggle against air pollution and noise pollution." Because of this statement, and the stipulations in the constitution regarding the protection of forests, wild creatures, and beneficial birds made public as early as 1974, Switzerland is considered to be the first nation to have incorporated environmental rights or matters closely connected with environmental rights into its constitution. By now, the issues constituting the basic content of environmental rights have been clearly recognized in the constitutions of a good many countries.

Through this process from which the concept of environmental rights came to be proposed, three conclusions can be drawn:

First, from the standpoint of the historical development of society, the proposition of environmental rights is the natural product of the development of the question of the human environment, and there is a definite tendency in the development of the constitutions, environmental laws and other related laws of the various countries to include environmental rights among the basic rights of nations and citizens, as a good example of social phenomena being produced by physical causes. The whole scope of environmental rights, therefore, has its roots deeply in the material life of human society. Although the development of the concept of environmental rights and the ways this development has been manifested in various countries have been exceedingly complex, nevertheless it has presented a course of development that is legally unified and is being strengthened daily. Therefore, the science of law under a socialist system should study the question of environmental rights in the same way. Of course, this study should be guided by Marxism-Leninism and undergo a scientific analysis of the conditions under which the proposition of environmental rights was produced, as well as an accurate estimate of their usefulness, so that this foreign concept can be properly implemented in China and used to promote

China's environmental protection work; it should not simply copy the specific stipulations of foreign countries regarding environmental rights.

Second, environmental rights is a core issue of environmental law, and the basis of environmental litigation. Environmental law embraces the entire scope of all laws which serve to adjust the various social connections arising out of the need for protection of the environment. The greater part of environmental rights as they relate to environmental law manifests itself in the two aspects of rights and responsibilities. Environmental law, then, based on these two aspects, expresses and defines the relevant social connections and, by means of the coercive power of the state, guarantees the legal forms necessary to implement them. The clearer and more concrete the laws of a country with regard to stipulations on environmental rights, the more complete the conditions for the further development of its system of environmental law and the more secure the basis for that system will be. Environmental litigation is based on the relevant environmental protection laws, for the purpose of preserving the advantage of people enjoying a good environment, and is an important avenue for solving environmental disputes. Since the development of the concept of environmental litigation has already been promoted, if the concept of environmental rights has not been clearly defined in law, it would be very difficult to develop environmental litigation. Therefore, immersing ourselves in launching programs of study on theoretical questions relating to environmental rights is very important for setting up a sound system of environmental law for our country, developing our country's environmental litigation, and solving environmental disputes.

Third, theory regarding environmental rights is in a developmental stage, and China's legal workers should make a contribution to a scientific theory of environmental rights. At present, there are many theories and views regarding environmental rights, and many issues are still being debated. For example, at the conference in support of human rights held by the Japanese Lawyer's Association in Niigata, Japan, in September 1970, the theory of absolute environmental rights was proposed, the core of which was the concept of the "agreement of all inhabitants," i.e., any change in the environment must obtain the agreement of all inhabitants. This theory considers that environmental rights take absolute precedence over other factors, and that environmental rights should take the form of concrete right to be heard in litigation. Another influential theory of environmental rights is called the guiding principle theory of environmental rights, or the explanatory theory of environmental rights. This theory considers that environmental rights are a stipulation based upon guiding principles and are not necessarily connected with any direct, concrete right to be heard; it is rather that, in order that environmental rights may be realized for everyone, the constitution must be revised or great changes must be instituted in the legal procedures currently in force. From the standpoint of the course of development of environmental rights, these diverging and contending aspects are entirely natural; the establishment of many other fundamental rights has passed through such a stage. Serious, conscientious social science workers absolutely should not avoid this kind of divergence, but should actively proceed with analysis and study of these aspects.

## The Content of Environmental Rights

The environmental rights discussed in this article are rights according to law, i.e., the various rights and interests bestowed by the law and connected to the law upon the principal parties to be enjoyed by them with regard to the natural environment they live in. Due to the fact that environmental pollution is largely the product of the development of modern industry, traditional laws in the past either made no stipulation at all or were not clear about the concept of environmental rights; hence, legal workers both in China and abroad have not come up with a unanimous viewpoint regarding the definition and content of environmental rights, and the stipulations regarding environmental rights in the legal literature of the various countries are also not completely alike. Under these circumstances, there are two ways of proceeding with a study of environmental rights: the first is to proceed from the basis of a predefined, general concept, and compare a scholar's definition against the complex legal provisions in effect in real life; the points that coincide could be recognized as representing environmental rights, and those that differ would not be accepted; another would be to proceed from the basis of the legal provisions regarding environmental rights in the laws currently in force, synthesize them, and generalize from them the primary content of environmental rights, clarifying the general concept, nature, and meaning of environmental rights. In view of the fact that at present a good many countries already have some stipulations on environmental rights in the various environmental laws and regulations they have promulgated, and that many countries also have specialized stipulations on environmental rights in their constitutions, I believe that if we want to clarify the general concept and meaning of environmental rights, the best method is to compare the provisions on environmental rights in the laws of the various countries. Because a constitution is a country's great, fundamental law, a comparative analysis of the stipulations on environmental rights in the constitutions of the various countries is even more important for our understanding of this question.

1. Environmental rights include three aspects--the environmental rights of nations, of legal entities, and of citizens, which together make up the unified whole of environmental rights.

In analyzing the stipulations regarding environmental rights in the constitutions of the various countries, there are generally three types, according to who is enjoying the right:

The first are the nation's environmental rights. A country's natural environment is the area and material conditions which that country relies upon for existence, including that country's sea lanes, airspace and territory. Therefore, a country's environmental rights are universally given preeminence in the laws of the various countries. From the standpoint of international law, countries are the subjects of international law, and a country's environmental rights consist of its right to engage in all actions in the exercise of the protection of its environment, and are a component part of a nation's right of sovereignty.



From the point of view of the internal laws of the various countries, a country's environmental rights consist mainly of the state's fundamental responsibility to protect the natural environment needed for the life of the people. For example, it is stipulated in article 110 of the Constitution of the Republic of Panama promulgated on 11 October 1972: "Based on the situation of the national economy and social development, actively protecting the ecological environment--and preventing environmental pollution and the disruption of the ecological balance--is a fundamental responsibility of the state." Article 24 of the Constitution of the Republic of Greece promulgated on 7 June 1975 stipulates: "Protecting the natural and cultural environments is a responsibility of the state, and the state should lay down particular preventive or coercive measures." Regarding these responsibilities, the constitutions of some countries make stipulations in comparative detail, while those of other countries do so according to more general principles. In comparing the relevant stipulations in the constitutions of the various countries, four principal aspects of a country's environmental rights appear: 1) the state's right of ownership over all publicly owned land, waterways, mines, and other natural resources is clearly stipulated, as in article 14 of the Philippines Constitution, as well as in the relevant provisions of the constitutions of Bulgaria, Poland, the German Democratic Republic, and the Soviet Union; 2) the scope of the natural environment to be protected by the state is clearly stipulated, as in articles 75, 77, and 93 of the Constitution of the Kingdom of Thailand, as well as the relevant provisions in the constitutions of Papua-New Guinea and Bulgaria; 3) it is clear that the state has the right to formulate all kinds of laws and regulations for the prevention and control of environmental pollution, as stipulated in article 151 of the Constitution of the Republic of Algeria, and the relevant provisions in the constitutions of Switzerland, Sweden, Chile, and Czechoslovakia; 4) the state's right to guarantee that its citizens obtain a healthy living environment is clearly stipulated, as in clause 18 of article 1 of the Constitution of the Republic of Chile and in the relevant provisions of the constitutions of Yugoslavia, Cuba, Thailand and Hungary. It is absolutely not by chance that the stipulations regarding the environmental rights of nations of a number of countries having different social systems, such as Greece, Chile, Bulgaria, and Yugoslavia, all appear in the name of the responsibility of the nation; it is because the natural environment is a fundamental condition for the existence of human society, while environmental pollution is an objective phenomenon that has followed in the wake of human economic activity; therefore, the protection of the natural environment possesses a universal and long-term nature. The establishment of the environmental rights of nations is actually the outcome of the enrichment and development of the theory of the function of the state and theories regarding the state and laws.

Second are environmental rights enjoyed by legal entities (i.e., government organs, organizations, and factories, mines and similar enterprises and units). For example, article 31 of the Constitution of the Republic of Bulgaria promulgated on 16 May 1971 stipulates: "Protecting nature and natural wealth, waterways, the atmosphere, the surface of the earth, as well as cultural remains, is the responsibility of state organs and enterprises, cooperative social groups, and social organizations...." Proceeding from the basis of the actual circumstances of environmental protection, it is not enough merely to stipulate the environmental rights of states and citizens. Because of the mobile nature of environmental pollution (the mobility of water and the atmosphere, the

transmission of noise), as well as the development of modern means of communication, the small universe of the individual no longer exists; also, due to the fact that in modern social life citizens frequently appear in the form of definite organizations and groups, and environmental pollution is created mainly by factories, mines, enterprises and units that discharge pollutants, environmental protection also generally manifests itself as a common issue of a group of people in the environment of a particular settlement. So the environmental rights of the legal entities which are intermediaries between the state and the citizens have the particular effect of forming a link between the former and the latter. Therefore, many countries place particular importance on the environmental rights of legal entities. For example, Soviet Russia's nature protection law, with regard to the protection of the soil, mineral resources, waterways, forests, and wild animals and plants, minutely and concretely stipulates the rights and duties of the legal entities such as factories and mining enterprises, farms and farming villages. Article 3 of Japan's fundamental legal countermeasures on public harm also lays down clear stipulations regarding the environmental rights of enterprises.

Third are environmental rights enjoyed by citizens. Article 193 of the Constitution of the Socialist Federated Republic of Yugoslavia promulgated on 21 February 1974 stipulates: "People have the right to a healthy living environment." The reason the environmental rights of citizens have been included within the scope of the protection offered by constitutions and, moreover, the reason they are urgently demanded by the broad masses, is because, first of all, in the wake of the development of modern means of production and modern lifestyles, a clean, comfortable natural environment has already become a fundamental condition for people to enjoy effective, and continuous work and a healthy, happy life. The functions of the natural environment are, first, to provide human beings with a place for life, work, and rest; and second, to provide human beings with all the natural resources required to develop their material and spiritual lives. If there is not a clean, agreeable natural environment that is able to guarantee the continuous provision of all the natural resources needed for the people's material and spiritual lives, then humanity will be without the means to continue to exist and develop. If a person's place of work and living is polluted or interfered with by a large quantity of poisonous and harmful substances, noise, and bad odor, then it is possible that the conditions for that person's existence can no longer be protected. Second, citizens' environmental rights are necessary conditions for the realization of their fundamental rights to property, labor, and existence, but they are not the equivalent of these rights. Before the environmental rights of citizens were clearly formulated, people frequently adduced other rights as the legal basis for protecting the well-being of the victims of pollution. For example, in the course of the litigation over Japan's Osaka Airport, presiding Judge Sawa Susumu gave the following account: "In circumstances of this kind, residents whose lives are jeopardized have the right, according to article 13 of the constitution (regarding the right of citizens to life, liberty, and the pursuit of happiness) to demand that the government adopt certain countermeasures." In fact, some countries have stipulated their environmental rights precisely from this point of view, as is stipulated in article 15 of the Constitution of the Socialist Republic of Czechoslovakia: "The state is concerned about beautifying nature and having nature thoroughly protected, and with protecting the beautiful natural scenery of the motherland, in order to create an increasingly richer source

for the sake of the happiness of the people's lives, and to create an appropriate environment for the sake of the health and rest of the laboring people." However, from this, one decidedly cannot reach the conclusion that the right to work, the right to rest, and other rights can be substituted for environmental rights. In actuality, each has its own conditions and course of origin and development, and each has its specific scope of application. At present, the environmental rights of citizens already cover a considerably broad area, and moreover are in the process of gradually developing from the prevention and control of environmental pollution to demands for comfort with regard to the environment (including the degree of quiet, cleanliness, pleasantness, and comfort), thus causing environmental rights to develop gradually into the most basic of rights.

From this it can be seen that the environmental rights of nations, legal entities and citizens are interconnected, and each also has its own particular effect and scope of application, among which the environmental rights of nations possess guiding significance, the environmental rights of citizens are the most basic, and the environmental rights of legal entities, though they are derived from the former two, nevertheless possess an important position in environmental protection work that cannot be overlooked. From the standpoint of the provisions of the constitutions of the various countries, some only stipulate the nation's environmental rights; some stipulate two or three kinds of environmental rights; some, in the provisions of various laws, separately stipulate the environmental rights of the nation, of legal entities, and of citizens, and some stipulate all three kinds of environmental rights in the same provision. For example, article 20 of the Constitution of the Socialist People's Republic of Albania stipulates: "Protecting the land, natural resources, waterways, and air from being spoiled or polluted is the duty of the state, economic and social organizations, and all the citizens."

2. Environmental rights include the two aspects of the right to enjoy the environment and the duty to protect the environment, and the two together form the scientific social proposition of environmental rights.

From the point of view of rights versus duties, the constitutions of the various countries generally have four types of stipulations regarding environmental rights: The first is environmental rights expressed by the specific term "rights." The second is environmental rights expressed by the specific term "duty." For example, article 50 of the Constitution of the Islamic Republic of Iran promulgated on 15 November 1979 stipulates: "In the Islamic Republic, it is the duty of the citizens to protect the living environment of the present generation and of our descendants." Third are environmental rights expressed simultaneously by both the specific terms "rights" and "duty." For example, article 66 of the Constitution of the Republic of Portugal, promulgated on 2 April 1976, stipulates: "All citizens have the right to enjoy a living environment in which their health will not be harmed; at the same time, they also have the duty to protect the cleanliness of the environment." Fourth are environmental rights which are not expressed in the form of the specialized terms "right" and "duty."

There is a viewpoint which considers that environmental rights indicates the right of citizens to enjoy a good environment and, moreover, firmly believes

that only if the legal standard of the term "right" had been clearly employed in the sections and chapters of a country's constitution dealing with the basic rights of citizens can they accurately be called environmental rights, and that if the legal standard of employing "duty" or some other term is used, they cannot be considered environmental rights. I consider that in studying and advocating environmental rights to proceed from the basis of an understanding of the unity of rights and responsibility would be much more beneficial and effective than to do so from the basis of separating rights and duties. Originally, rights and duties were distinct from one another. A person had the right to decide whether or not to exercise his own rights, but if he did not fulfill his duties would be punished by law. From this standpoint, to speak of rights and duties as the same thing would not be proper. However, while rights and duties are distinct from one another, they are also connected. Marxism considers that: "There is no right without responsibility, and there is no responsibility without right."<sup>2</sup> If rights are stipulated, then the corresponding duties are pointed out by implication, and if duties are stipulated, then one will have bestowed upon others the right to demand that the persons concerned fulfill those duties according to the law. In law, there is no great distinction between stipulating, after all, rights, duties, or a combination of the two, and what basis to proceed from is generally a matter of convenience. Due to the intrinsic characteristics of environmental pollution and environmental protection work, it is especially worthwhile for us to immerse ourselves in the study and discussion of how to formulate environmental rights. From the point of view of the actual situation of the stipulations regarding environmental rights in the laws of the various countries, the laws have definitely not followed the restrictions designated by any one jurist, but have realistically reflected the new circumstances of actual life in all their multiplicity. From the point of view of the position of environmental rights within the constitutions, some countries put them in the general principles section or the preface, others place them in the chapters and sections dealing with the basic rights and duties of citizens, and still others place them in the chapters and sections dealing with the country's social and economic system. From the point of view of the relationship between rights and duties, some countries employ the two terms distinctly, while others do not distinguish between them. From the point of view of the direction of development, there is a tendency for the stipulation of environmental rights in the form of a unity of rights and duties to be accepted by more and more countries, laws and legal workers and, moreover, to be reflected in the three aspects of environmental rights for nations, legal entities and citizens.

In the area of international environmental law, principle 21 of the "Human Environment Manifesto" stipulates: "According to the UN Charter and the principles of international law, each country possesses the right to develop its natural resources in accordance with its environmental policies. At the same time, it also has the responsibility to insure that its activities within other jurisdictions and areas of control do not harm any other country's environment or the environment of any area outside the country's jurisdiction." This clearly states that a country's environmental rights include the two aspects of rights and responsibilities. The sections on the environmental rights of the nation in the constitutions of some countries also stipulate them in their two

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2. Complete Works of Marx and Engels, Chap 16, p 16.

aspects of rights and duties. For example, since articles 24 and 25 of the Constitution of the Federation of Switzerland stipulate the rights of the Federation with regard to the natural environment (for example, the right to utilize, supervise, and pass laws regarding the environment), they also stipulate the Federation's duties. The environmental rights of legal entities in the same way include the two aspects of rights and duties. For example, since articles 12 and 18 of the Constitution of the USSR promulgated on 7 October 1977 stipulate the right of legal entities to utilize the environment, they also stipulate their duty to protect the environment. With regard to the environmental rights of citizens, from the point of view of the provisions of the constitutions of the various countries currently in force, constitutions which stipulate environmental rights in the form of citizen's "duties" or simultaneously in the form of citizens' "rights" and "duties" are in the majority, while constitutions which stipulate environmental rights only in the form of citizens' "rights" are relatively fewer. This circumstance is brought about by the fact that the right of citizens to enjoy a good environment and their duty to protect the environment are frequently interconnected and, moreover, the stipulation of the citizens' duty to protect the environment tends to assist in the realization of their right to enjoy that environment.

In sum, there are environmental rights in both the narrow and the broad sense. Environmental rights in the narrow sense generally indicate the environmental rights of citizens, i.e., the citizens' right to enjoy a good, proper natural environment. Environmental rights in the broad sense indicate generally the rights to be enjoyed and the duties to be assumed by all major bodies having some connection with the law (including natural people, legal entities, special legal entities--the state) with respect to the natural environment they exist in; that is, the state, organizations, groups, and enterprises and units such as factories and mines, as well as the citizens all have the right to utilize and enjoy the natural environmental conditions they exist in, and they also all have the duty to protect the natural environment and prevent environmental pollution. Although the narrow and broad senses of environmental rights reflect the different points of view people have adopted toward the problem, as well as the different areas to be covered by environmental protection, nevertheless whether one proceeds from the point of view of study and theory or from the point of view of the requirements of the actual situation, the concept of environmental rights in the broad sense is more important and more valuable.

#### Regarding China's Laws and Environmental Rights

We should be aware of the fact that the laws of China do have some provisions concerned with environmental rights. For example, section 1, item 11 of the "Constitution of the People's Republic of China" stipulates: "The state shall protect the environment and natural resources, and shall prevent and deal with environmental pollution and other types of public harm." This stipulation belongs in the category of the environmental rights of nations. And the "Environmental Protection Law of the People's Republic of China (provisional)" more specifically concerns the rights and duties of the state, legal entities and citizens in protecting the environment. For example, article 2 of this law stipulates: "The duty of the environmental law of the People's Republic of China is to guarantee, in the process of building the four modernizations, the

reasonable use of the natural environment, and the prevention and cure of environmental pollution and the spoiling of the ecology, in order to create a clean and proper living and work environment for the people, protect the people's health, and promote their economic development. The phrase "in order to create a clean and proper living and work environment for the people" can be understood as the state's recognition of the "people's right to enjoy a clean and proper environment." In addition, other laws and regulations also stipulate rights and duties in certain environmental protection areas; for example, article 7 of the "Forest Law of the People's Republic of China (provisional)" stipulates: "Planting trees and creating forests, and caring for them, is the glorious duty and right of all the people of the nation."

However, one can see from these laws that the standard of our country's laws on environmental pollution is not clear or complete enough. China's constitution only briefly stipulates the responsibility of the nation with regard to environmental protection, and does not stipulate the rights and duties of organizations, groups, enterprises and units such as factories and mines, and citizens in environmental protection work. Although the stipulations in China's environmental protection law and other related laws and regulations regarding the responsibilities and duties in environmental protection work of the nation, units, and citizens are comparatively clear and complete, nevertheless they seldom deal with, or are not clear, regarding the rights of the nation, enterprises and units, and citizens to enjoy good environmental conditions. For this reason, the question at present is not whether or not we want to stipulate the issue of environmental rights in our country's laws, but how to further revise, round out, clarify, and bring into prominence the question of environmental rights.

The "Resolutions Regarding the Revision of the Constitution and the Setting Up of a Committee to Revise the Constitution" resulting from the Third Session of the Fifth People's Congress point out that, regarding the revision of the constitution, we must turn the matter over to all the people of all nationalities in the entire nation for discussion, in order to pool their wisdom and formulate a constitution that is adapted to the general duties and requirements of China in this new period of historical development. The revision of China's environmental protection law is also in line with this guiding principle. On the basis of this spirit, and in view of the present condition of the stipulations in China's laws regarding environmental rights as well as the actual needs of China's environmental protection work, I consider that in China's Constitution we should, in a principled way, stipulate the rights and duties with regard to environmental protection work of the nation, units, and citizens; and in civil law, economic law, and the various other laws relating to environmental protection we should further clarify and make more specific the rights and duties of the three groups with regard to environmental protection. The reasons are as follows:

1. Due to the important effect of the protection of the natural environment on China's four modernizations project, it is necessary to clarify and emphasize environmental rights in our laws.

At present, China has already entered a new period of historical development. The general duty of our party and nation during this new period of historical



development is to unite all the people of the various nationalities in China so that they, with one mind and one heart, in a planned way, and according to the proportionate representation of their numbers, can achieve greater, faster, better, and more economical results in developing our socialist economy, and build a strong, modern, socialist country with a high level of democracy and civilization. Since China's natural environment and natural resources are the material basis for China's modernization project, and also constitute the place and the conditions under which the people of China will make a concerted effort toward building the four modernizations, they are very closely connected with the speed and prospects of the four modernizations project. Since the establishment of a fine and proper work, study, and living environment is an important aim in the building of socialist modernization and is also an important aspect of being a strong, socialist, highly civilized nation, it has a bearing on the immediate well-being of all the people of China. However, the present situation of environmental protection in China is definitely not adapted to the requirements of the new period. Although we have done a great deal of work, nevertheless environmental pollution still continues to develop, and has already become a new, important problem for the building of the four modernizations. According to statistics, over 100 million tons of smoke and dust are discharged into the environment every year in China, along with 15 million tons of sulphur dioxide, making it one of the top countries in the world in terms of the quantity of pollutants discharged. Throughout our country each year over 25 billion tons of polluted water, resulting from both industrial and ordinary use, are discharged, so that economic losses each year due to water pollution alone amount to 5.5 billion yuan, a figure which is substantially equivalent to the amount lost through air pollution. The unchecked proliferation of pollutants constitutes a vast waste of our natural resources and energy sources. At present China's utilization rate for energy sources is only 28 percent, while the energy source utilization rate for the United States and Japan is over 50 percent; even if we raise our utilization rate to 40 percent, we will still be wasting 100 million yuan and several tens of millions of tons of fuel per year. With regard to the natural environment, over the past 30 years the desertification of land in China has increased by 60,000 square kilometers; each year our forests are reduced by 2.5 million hectares; because of soil erosion, each year we lost over 5 billion tons of soil, and with it an amount of nitrogenous, phosphate, and potash fertilizer equivalent to the total quantity of chemical fertilizer applied by China's agriculture in a year; and the area of inland bodies of water has been reduced by 7 percent [over the past 30 years] due to the blind construction of farmland around lakes. All these factors have a far-reaching and serious negative effect on the development of China's industrial and agricultural production. If we want to solve these problems, it will be necessary to mobilize the forces of the state, legal entities and all of the people, and for this it will be necessary to stipulate clearly in our national laws for the new historical period, the rights and duties of the state, legal entities and citizens regarding environmental protection. Otherwise, if the laws for the new historical period do not reflect the new period's problems, then the continuing development of environmental pollution will become a bitter result and a serious obstacle to the building of the four modernizations.

2. To round out the concept of environmental rights and bring it into prominence in our laws is an important guarantee of doing a good job in environmental protection work in China.

Due to the fact that the factors creating China's environmental pollution are exceedingly complex, environmental protection is a synthesis involving many fields of study and many departments, and this means that the fundamental outlet for China's environmental protection work lies in implementing the party's mass line, relying on the masses, and having everyone set to work. However, some of our comrades are in the habit of engaging in a "stupid people" policy, which has arisen from an unwillingness to accept the fact that socialist China does have an environmental pollution problem, and afterward, when pollution became so serious that it could no longer be ignored, they tried to minimize it or gloss over it, with the result that they dare not bestow environmental rights on the masses for fear that once this is done the masses will raise improper demands. This is one of the important causes of the backwardness of China's environmental protection work. Actually, environmental rights definitely do not imply the making of harsh demands regarding the environment that depart from reality; having the right to enjoy a good environment, one also has the duty to protect the environment; once the masses make the connection between the quality of the environment and their own immediate well-being, this will become a powerful social force for protecting the environment. In addition, environmental rights are the same as the right to democratic freedoms, the right to work, and the right to rest; in order to change programmatic, guiding principles into concrete principles that can be used as a basis for litigation, they must still go through the process of being subject to concrete, actual legal provisions; it is definitely not the case that, having environmental rights, one can then instigate environmental litigation at will or make trouble without just cause. In actuality, clearly stipulating environmental rights in our laws is a means of regularizing the mass line in the party's environmental protection work in the form of a fundamental right of the people. This not only places on all levels of government the responsibility for safeguarding the people's environmental rights, but as a result, places the problem of environmental protection on the agenda of government work, and moreover, bestows on the broad masses the right to supervise all activities that cause environmental pollution and to demand the improvement of environmental conditions. In this way, China's environmental protection work will have a continuous forward impetus and legal guarantee.

3. Under our socialist system, environmental rights are a necessary condition for the exercise of citizens' right to work, right to rest, and other fundamental rights. China's Constitution, promulgated many times over, clearly stipulates many basic rights for our citizens, and this is a concrete manifestation of the popular, democratic nature of socialist constitutions. For example, article 48 of the "Constitution of the People's Republic of China" promulgated in 1979 stipulates: "Citizens shall have the right to work. The state, based on the principle of taking all factors into consideration, will make arrangements for the citizens to labor and take up occupations and, on the basis of increasing production, will gradually increase remuneration for labor, improve working conditions, strengthen labor protection and improve the collective well-being, in order to guarantee the citizen's enjoyment of these rights." Article 49 stipulates: "Workers have the right to rest. The state shall fix the times for labor and the systems for taking leave, and shall gradually expand the workers' material conditions for rest and recuperation, in order to guarantee the workers' enjoyment of these rights." From the point of view of



environmental protection, these working conditions and labor protection measures indicate principally the protection of the workers' work environment; and the material conditions for the workers' rest and recuperation include the living environment in which the workers rest. Whether work environment or living environment, both are part of the natural environment on which people depend to exist. Although requirements for the quality of a work environment differ according to whether the work is physical or mental, the quality of that work environment will always have an effect upon a person's spirit and psyche, influence the worker's enthusiasm and creativity, and have an effect upon the quantity and quality of the material and spiritual wealth created by the worker. As for the material conditions for workers' rest and recuperation, in addition to clothing, food, shelter, and transportation, fresh air, and fine, agreeable surroundings with blue sky, clear water, and green shade trees are also required, and this will have an effect on the preservation and renewal of their capacity for labor. One can see, then, that the citizens' right to work and right to rest are inseparable from the protection of the natural environment. If the work or living environment is seriously polluted, the workers are without protection during their work time and cannot get proper rest during their rest time; the workers' health and lives will be threatened by all kinds of polluting factors, and the workers' rights to work and to rest will become empty words. At present the situation of China's environmental pollution is still comparatively serious, and to one degree or another it has already had a negative effect upon the exercise of citizens' rights to work and to rest. For example, noise pollution and the pollution of the air and water sources in the cities of China are already problems urgently in need of a solution, and have already had some negative effect on people's work, study, and rest. These problems are already arousing more and more the serious attention of the state and the people; moreover, positive measures for their gradual solution are in the process of being adopted. However, once we have stated that we want to guarantee the citizens' exercise of their rights to work and rest, and other basic rights, then we must clearly stipulate that citizens enjoy environmental rights. For this reason, clarifying and emphasizing citizens' environmental rights is really a problem urgently in need of a solution in China's law, and a pressing problem that is close to the people's hearts.

(Responsible editor of this article, Shen Xi [3476 3556])

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CSO: 5000/4046

## TEXT OF PRC MARINE ENVIRONMENTAL PROTECTION LAW

OW280545 Beijing XINHUA Domestic Service in Chinese 0217 GMT 24 Aug 82

[Text] Beijing, 24 Aug (XINHUA)--Law on Marine Environmental Protection of the People's Republic of China

### Chapter I

#### General Principles

##### Article 1

The Law on Marine Environmental Protection of the People's Republic of China is formulated to protect its marine environment and resources, prevent pollution, ensure ecological balance, protect the health of the people and promote the development of marine undertakings.

##### Article 2

The law is applicable to the inland seas and territorial waters of the People's Republic of China as well as to other sea waters under the jurisdiction of the People's Republic of China.

The law is to be observed by all vessels, drilling platforms, aircraft, submersible devices, enterprises, institutions and individuals engaged in navigation, prospecting and development of natural resources, production, scientific research and other activities in the sea waters within the jurisdiction of the People's Republic of China.

The law also applies to cases involving pollution of sea waters within the jurisdiction of the People's Republic of China as a result of dumping of waste materials in foreign waters.

##### Article 3

All institutions and individuals entering the sea waters under the jurisdiction of the People's Republic of China have the responsibility of protecting the marine environment and the duty of surveilling and informing against acts of polluting the marine environment.

#### Article 4

The concerned departments under the State Council and the people's governments of the coastal provinces, autonomous region and municipalities directly under the jurisdiction of the central authorities may, in view of the need to protect the marine environment, designate special marine conservation zones, marine natural conservation centers, seashore resorts and tourist spots and may adopt relevant protective measures. However, the setting up of special marine conservation zones and marine natural conservation centers must have the approval of the State Council.

#### Article 5

The environmental protection departments under the State Council are in charge of marine environmental protection work throughout the country.

The state departments of oceanographic administration are responsible for organizing investigation, monitoring, surveillance and scientific research of the marine environment. They are also in charge of environmental protection work with regard to preventing pollution caused by prospecting and development of offshore oil resources and the dumping of waste materials.

The harbor superintendency administration of the People's Republic of China is responsible for controlling, investigating and handling pollution caused by vessels, as well as surveilling the harbor waters. It is also in charge of environmental protection work with regard to preventing pollution from vessels.

The organizations of state fishery administration and fishing port superintendency administration are responsible for controlling pollution from vessels in fishing ports and for monitoring the waters of fishing ports.

The military environmental protection departments are responsible for controlling pollution from naval vessels and for monitoring the waters of naval ports.

The environmental protection departments of the coastal provinces, the autonomous region and municipalities directly under the jurisdiction of the central authorities are responsible for organizing, coordinating, controlling and inspecting the marine environmental protection work within their respective administrative regions. They are also in charge of environmental protection work with regard to preventing pollution caused by coastal projects and pollutants from the land.

[OW280547] Chapter II

#### Prevention of Marine Environmental Pollution From Coastal Projects

#### Article 6

Before working out a plan for its work, the competent units in charge of coastal construction projects must conduct scientific surveys on the marine environment and select a suitable site for construction in light of natural and social

conditions. With the relevant state regulations in mind, the concerned units must write a report on the estimated effects of the project on the environment.

#### Article 7

Appropriate measures must be taken to protect aquatic resources in building harbors, oil wharves and tidal power generation and water conservancy projects at river mouths. The necessary facilities must be built to enable fish to pass through when dams are constructed which would otherwise block the migratory passage of fish and crabs.

#### Article 8

Ports and oil wharves must be installed with equipment for collecting and treating residual and waste oil, oil-contaminated water and waste materials. Besides, antipollution equipment, monitoring and warning devices must also be installed.

#### Article 9

The development and utilization of tidal land must be subject to overall planning and strict control. Quarrying projects and projects for reclaiming land from the sea must be brought under strict control. Where such projects are necessary, a report on the estimated effects of the project on the environment, on basis of the investigation and study of the economic returns of the project, must be submitted to the environmental protection departments of the provinces, autonomous region and municipalities directly under the jurisdiction of the central authorities for examination and approval. Large reclamation projects must be reported to the environmental protection departments of the State Council for examination and approval.

Destruction of shelter forests, scenic forests, scenic rocks, mangroves and coral reefs in coastal areas is prohibited.

### Chapter III

Prevention of Pollution to the Marine Environment From Offshore Oil Prospecting and Development

#### Article 10

Before submitting a plan for its work, the enterprises or competent units engaged in offshore oil exploitation must submit a report on its estimated effects on the marine environment to the environmental protection departments of the State Council for examination and approval. The report should include effective measures for the prevention of pollution to the marine environment.

#### Article 11

Effective measures must be taken to protect fishery resources when demolition is required in offshore petroleum prospecting and other operations.

#### Article 12

It is necessary to strengthen control over oil used in the process of petroleum prospecting and exploitation in order to prevent accidental oil leaks. The residual and waste oils must be recovered and must not be allowed to be discharged into the sea.

#### Article 13

The oil-contaminated water and oil-containing mixtures of offshore oil drilling vessels and drilling and extracting platforms must not be discharged directly into the sea. They must be recovered and treated before discharge and the oil content of the discharged fluids must not exceed the state standard.

#### Article 14

The oil-containing industrial garbage of oil drilling vessels, and drilling and extracting platforms must not be disposed into the sea. Fishing zones and sea-lanes must not be polluted when disposing of other industrial garbage.

#### Article 15

In oil testing operations, oil and oil-containing mixtures must not be discharged into the sea and measures must be taken to see that gases and oil being tested are burned completely in order to prevent the pollution of the sea.

#### Article 16

It is essential that gas pipelines and oil storage installations on the sea are resistant to seepage, leakage and corrosion and that they are always kept in good shape to prevent accidental oil leaks.

#### Article 17

In prospecting and exploiting offshore oil resources, it is necessary to prepare installations and equipment to prevent pollution and take effective technological measures to avoid accidental blowouts and oil leaks.

Accidental blowouts and oil leaks must be reported immediately to the state oceanographic administration departments while at the same time taking effective measures to control and eliminate the oil pollutants. Such accidents are subject to investigation and handling by the state oceanographic administration departments.

#### [OW280549] Chapter IV

#### Prevention of Marine Environmental Pollution and Damages by Pollutants From Land Sources

#### Article 18

To discharge harmful matter into the sea, coastal units must strictly implement the discharge standards and relevant regulations promulgated by the state or the

people's governments of provinces, the autonomous region or municipalities directly under the central government.

No new sewage outlets may be constructed in marine natural conservation centers, aquatic product breeding grounds or seaside scenic and tourist resorts. Sewage outlets built before the promulgation of this law, where the pollutants discharged fail to meet state pollutant discharge standards, should be corrected within a specific time limit.

#### Article 19

Waste water containing strong radioactive matters is forbidden from being discharged into the sea.

Waste water containing weak radioactive matters, which indeed has to be discharged into the sea, must be handled according to state radioactive protection regulations and standards.

#### Article 20

Medical waste water containing germs or viruses of infectious diseases and industrial waste water must be treated and strictly sterilized to eliminate the germs or viruses before being discharged into the sea.

#### Article 21

Discharge of industrial and household waste water containing organic and nutritious matters into bays, semisealed off sea waters and other sea waters with relatively poor self-cleaning abilities should be controlled to prevent the sea waters from becoming overnutritious.

#### Article 22

In discharging heated waste water into the sea, measures should be adopted to ensure that temperatures of nearby fishery waters meet state water quality standards and to avoid the harmful effects of heat pollution on marine resources.

#### Article 23

State regulations and standards on safe application of agricultural chemicals should be followed when applying agricultural chemicals on coastal farmlands.

#### Article 24

Without the approval of the environmental protection departments of the coastal provinces, autonomous region and municipalities directly under the central government, no unit may dump or pile up tailings, slag, coal ash and cinder, garbage or other waste materials on seashores and beaches. When dumping and treatment grounds for waste materials are legally approved for establishment on seashores or beaches, protective dikes should be built to prevent the waste materials from being washed into the sea.

## Article 25

The environmental protection departments and river system management departments of the coastal provinces, autonomous region and municipalities directly under the central government should strengthen the control of rivers flowing into the sea--preventing and controlling pollution--to maintain good water quality at the mouths of the rivers.

## Chapter V

### Prevention of Marine Environmental Pollution and Damages by Ships

## Article 26

In the sea waters within the jurisdiction of the People's Republic of China, ships are forbidden to discharge oils, oily mixtures, waste matter and other harmful matter in violation of the stipulations of this law.

## Article 27

Tankers over 150 gross tonnage and nontankers over 400 gross tonnage should be equipped with the appropriate antipollution facilities and apparatuses.

Tankers under 150 gross tonnage and nontankers under 400 gross tonnage should be equipped with special containers for recovering oil residue and waste oil.

## [OW280550] Article 28

Tankers whose gross tonnage exceeds 150 dun and nontankers whose gross tonnage exceeds 400 dun should keep their own oil records.

Ships that carry over 2,000 dun of cargo oils in bulk should keep a valid "Certificate of insurance of civil responsibility for damage done by greasy dirt or other financial assurances," or a "Certificate of credibility concerning civil responsibility for damage done by greasy dirt" or they should provide other assurances of financial credibility.

## Article 29

When discharging oily waste water, tankers whose gross tonnage exceeds 150 dun and nontankers whose gross tonnage exceeds 400 dun should comply with state requirements and regulations governing the discharge of waste water ships and should truthfully indicate the matter in their oil records.

## Article 30

When discharging deck washing water and other residual matter, ships that carry poisonous and corrosive cargoes should comply with state regulations governing the discharge of waste water from ships and should truthfully indicate the matter in their log books.

#### Article 31

When discharging radioactive matter, nuclear-powered ships and ships that carry radioactive matter should observe the provision in Article 19 of this law.

#### Article 32

When loading and unloading oils, ships should follow the operation procedure and take effective precautionary measures to prevent oil leakage accidents.

#### Article 33

Shipbuilding, ship-repairing, shipbreaking and salvage units should be equipped with pollution prevention instruments and installation. While in operation, they should take precautionary measures to prevent oils, oily mixtures and waste matter from polluting the sea.

#### Article 34

When a ship creates pollution because of inappropriate discharges of oil, oily mixtures and other harmful matter or because of the falling of poisonous and corrosive cargoes into the sea, it should take immediate measures to control and eliminate the pollution, report the incident to the nearest port administration supervisor and accept his investigation and handling.

#### Article 35

When a ship is damaged in an accident that results or may result in serious pollution and damage to the marine environment, the PRC Port Administration supervisor is authorized to take compulsive measures to avoid or reduce the pollution and damage.

#### Article 36

All ships are obliged to oversee cases of marine pollution. They should immediately report to the nearest port administration supervisor. The fishing vessels may report to the nearest fishing administration, fishing port supervisory and management organs as soon as they notice activities that violate regulations and cause pollution.

#### Article 37

When pollution is caused by a ship sailing, berthing and operating in waters under the jurisdiction of the PRC, the PRC Port Administration supervisor will board the ship to investigate and handle the matter. Authorized by the port administration supervisor, civil employees of government departments concerned may also board the ship to investigate and report the investigation's results to the port administration supervisor for handling.



## Chapter VI

### Prevent Dumped Discards From Polluting and Damaging Marine Environment

#### Article 38

Without the approval of the state oceanographic administration departments, no unit is allowed to dump discards in waters under the jurisdiction of the PRC.

Units that need to dump discards should file applications with the state oceanographic administration departments. They are allowed to dump discards only after the State Oceanographic Administration Department has examined and approved their applications and has issued them permits.

#### Article 39

Units that have been permitted to dump discards should do so in designated areas according to the time limit and conditions stated in their permits. The approving department should verify the discards after they have been loaded. Discards to be dumped from ships should be verified by the port administration supervisor who is sailing away from the port.

#### Article 40

Units that have been permitted to dump discards should make a detailed record of the dumping process and report, in writing, to the approving department after the dumping is completed. Ships that dump discards should report, in writing, to the port administration supervisor who is sailing away from the port.

[OW280915] Chapter VII

### Legal Liability

#### Article 41

The related department specified in Article 5 of this law as being responsible for the work may instruct those who have violated this law and have caused or possibly caused pollution of and damage to the marine environment to bring the pollution under control within a specified time limit and to pay for the expenses of getting rid of the pollutants and eliminating the pollution and to pay for the pollution and damage done to the state. It may also issue warnings or impose fines on them. If the litigant refuses to accept the ruling, he may begin legal procedures at the people's court within 15 days after he has received the ruling. If he neither begins legal procedures nor carries out the instructions of the ruling, the related department in charge of this matter may ask the people's court to enforce the ruling.

#### Article 42

The unit or individual suffering damages caused by marine environmental pollution has the right to ask the party that has caused the pollution and the damage

to pay for the losses. Disputes with regard to the liability and the amount of compensation may be handled by the related department in charge of this matter. If the litigant refuses to accept the ruling, the matter may be solved according to the procedure specified in the provisions of the "PRC Law of Civil Procedure (for trial implementation)" or may take direct legal procedures in the people's court.

#### Article 43

Liability to pay compensation is exempted if damages from pollution are inevitable under one of the following conditions after reasonable and timely measures have been taken to protect the marine environment:

1. Act of war;
2. unavoidable natural disaster;
3. negligence or other errors made by the related department in charge of lighthouses or other navigational aid facilities in the course of performing its duties.

The third party must assume the liability to pay compensation if the pollution of and damage to the marine environment are caused entirely by errors of or something deliberately done by the third party.

#### Article 44

When public or private property has been seriously damaged or when there has been loss of life or injuries because of pollution of and damage to the marine environment in violation of this law, the judicial organ may take action against the person or persons directly responsible for such pollution or damage to determine criminal liability according to law.

#### Chapter VIII

#### Appendices

#### Article 45

The definition for the following terms cited in this law are as follows:

1. The "pollution of and damage to the marine environment" refer to the detrimental effects caused by the direct or indirect discharge of materials or energy into the marine environment harming marine life and resources, endangering human physical conditions, hampering fishery and other legitimate marine activities and impairing the quality of ocean water and the environment.
2. "Fishery zones" refer to spawning grounds, feeding grounds, overwintering grounds and migration passages for fish and shrimp as well as grounds for raising fish, shrimp, clams and seaweed.
3. "Oils" refer to any type of oil and its refined products.

4. "Oil-containing mixtures" refer to mixtures with any oil content.
5. "Discharge" refers to any act of discharging pollutants into the ocean including pumping, overflowing, seeping, gushing and dumping.
6. "Dumping" refers to the act of discharging wastes and other harmful materials into the ocean via ships, aircraft, platforms and other means of transportation including the act of abandoning ships, aircraft, platforms or other floating implements.

#### Article 46

The existing rules and regulations with regard to the protection of the marine environment that contradicts this law must take this law as the criterion.

#### Article 47

The Environmental Protection Department of the State Council may work out detailed rules and regulations in accordance with this law and submit them to the State Council for approval and enforcement.

In accordance with this, the department concerned of the State Council, the standing committees of the people's congresses and the people's governments in various coastal provinces, autonomous region, and municipalities directly under the central government may formulate specific, detailed measures for the enforcement of this law in close connection with the actual conditions in the respective department or area.

#### Article 48

This law will come into effect as of 1 March 1983.

CSO: 5000/4077

'RENMIN RIBAO' COMMENTATOR ON MARINE LAW

HK270651 Beijing RENMIN RIBAO in Chinese 25 Aug 82 p 3

[Commentator's article: "Exploit Marine Resources, Protect Marine Environment"]

[Text] The "PRC Law on Marine Environmental Protection," adopted by the 24th Congress of the 5th NPC Standing Committee, is of great importance to exploiting marine resources, to protecting marine environment and to developing our country's marine undertakings in an all-round way.

China's continental coastline is more than 18,000 kilometers long. The country has a vast territorial sea and has jurisdiction over a vast maritime area. The country is also endowed with rich marine resources. There has been a quick development of various marine undertakings in China such as coastal economic construction, marine petroleum, sea transport, sea fishery, refining salt through seawater, and marine research and study. At the same time, more and more harmful waste has been discharged into China's seawater every year--sewage alone amounting to billions of tons. China's marine environment has been polluted to varying degrees. Certain river mouths, sea areas, seaports and coastal regions have suffered relatively serious environmental pollution; there has been an increase in the poisonous substances retained within marine organisms, thus causing a shift of fishing zones to outer sea areas; and beach breeding farms in a very few areas lie uncultivated due to pollution. Certain famous seashore resorts have also been polluted. Therefore, paying equal attention to exploiting marine resources and protecting marine environment is an important task in developing China's marine undertakings.

Protecting the marine environment requires a correct policy on exploitation, science and technology, and also requires strict management. In particular, it requires a sound legal system. This is an important international experience gained in protecting the marine environment. Since the 1970's, China has issued a number of marine regulations which have played some role in protecting marine environment. However, due to the fact that China began late on its legislative work concerning marine environment, it only issued some regulations aimed at protecting certain objects or some specific sea areas. Such regulations cannot fully meet the needs of the development of China's marine undertakings. The currently promulgated Law on Marine Environmental Protection is a comprehensive code applicable to all marine waters of China. The Law on Marine Environmental Protection gives comprehensive consideration to various marine undertakings'

requirements for environmental conditions, and contains clear and definite regulations for dealing with the current major activities that are polluting our marine environment. The promulgation and enforcement of this code mark a great advancement in China's legislative work concerning marine environment.

Will the enforcement of legal management of the dumping of wastes into the sea hamper the growth of our coastal economy and certain marine development projects? We should unequivocally say, no, it will not. The formulation of the code is not aimed at passively preserving the natural features of the ocean but is aimed at correctly handling the relationship between exploiting marine resources and protecting marine environment, and at promoting an all-round development of various marine undertakings. The Law on Marine Environmental Protection does not absolutely forbid the use of the ocean to dispose of waste. The code demands a scientific and rational application of the ocean's purifying function, and also demands that waste be properly discharged on the premise of maintaining a fine marine environment. It is necessary to impose restrictions on acts that seriously impair the marine environment. Such restrictions conform to the overall and long-term interests of China's marine undertakings; they must be imposed even at the cost of adversely affecting certain activities.

[HK270653] The major characteristics of marine environmental pollution are widespread pollution of aquatic resources and extensive proliferation of pollution. Therefore, merely relying on environmental protection departments to promote the prevention and control of marine environmental pollution is not enough. Units that are engaged in exploiting marine resources and building marine projects must conscientiously carry out the regulations listed in the Law on Marine Environmental Protection, bring the work of environmental protection into construction plans, and avoid taking the roundabout course of creating pollution prior to adopting measures to control it. All units that use the ocean for the disposal of waste must strictly abide by the Law on Marine Environmental Protection and dispose of waste in a planned way; units which have gone beyond the limit set on the disposal of waste must actively adopt measures to control their disposal of waste. Relevant scientific research departments must actively carry out scientific research on the prevention and control of marine pollution and provide a scientific basis for implementing the Law on Marine Environmental Protection and promoting the prevention and control of marine pollution.

Marine environmental protection departments and local governments in coastal areas bear greater responsibility for implementing the Law on Marine Environmental Protection and for protecting our marine environment. They must conscientiously do their duty, strictly carry out the management work and enforce the law in all earnestness. At the same time, they must also promote relevant propaganda and educational work, create a common social practice of taking good care of marine environment, and mobilize the masses to participate in marine environmental management, so as to successfully promote China's marine environmental protection and to benefit future generations.

CSO: 5000/4077

## KEY MEASURES TO PREVENT, CONTROL MARINE POLLUTION STRESSED

Beijing RENMIN RIBAO in Chinese 25 Aug 82 p 3

[Article by Zhu Xiaocheng [4376 2400 4453] and Yang Jinsen [2799 6855 2773]:  
"Grasp the Key Measures in Preventing and Controlling Marine Pollution"]

[Text] In an accident in 1969, 110,000 gallons of No 2 fuel oil leaked into the ocean at West Falmouth, Jamaica. A large number of marine organisms were killed; a long time later the shellfish were still not edible. Since then, people have gradually recognized that after a large quantity of waste water, petroleum, insecticides, and other poisonous substances have been allowed to enter the ocean to pollute the marine environment, mankind is beginning to face retribution and there is a need for prevention and treatment.

In order to prevent ocean pollution effectively in order to protect the marine environment, a new science has emerged--marine environmental science--to study the ways by which pollutants enter the ocean, the pattern of their distribution and change, and their effects on the marine environment and human health, so as to provide a basis for the work of marine environment protection. Meanwhile, a number of marine environmental protection organizations have appeared in coastal countries and world organizations to produce a body of marine environmental protection laws and regulations to strengthen the work of managing the marine environment through administrative and legislative methods.

Ocean pollution is characterized by extensive sources of pollutants, large areas of dispersion, and a prolonged period of retention. Some key measures must be grasped in prevention and control work:

1. Attention must be given to the sources of pollutants. The work of managing the marine environment must have prevention and control as the primary goal in order to manage the source of pollutants well. Pollutants produced by human activities enter the ocean through rivers, rain, falling dust, artificial dumping, waste discharge of ships, and the mining of offshore oil wells. In China, the major factors that are polluting and damaging the marine environment include the following: 1) Pollutants of land origin: according to a survey of related departments, 5-6 billion tons of sewage and industrial waste water enter the ocean from China every year, in addition to 10 million tons of other waste materials. 2) Wastes discharged from ships: at present, China has several hundred thousand motorized boats of all kinds. Every year, foreign ships enter

Chinese harbors and sail through seas under Chinese jurisdiction several thousand times and they discharge a large quantity of oil-containing waste water into the sea. 3) With the prospecting and developing of offshore oil, the quantity of petroleum from runoff, gushing, dripping, and leaking amounts to a great deal. 4) Poorly-planned marine engineering structures cause some deep-water ports and navigation channels to silt up and some local areas of the sea to lose ecological balance. 5) Poisonous and harmful substances dumped by people.

As we launch the work of protecting the marine environment, the work of managing these pollutants should be emphasized in order to reduce the amount of pollutants entering the sea as much as possible so as to avoid the tortuous road of polluting first and treating later.

2. Dealing with the major harmful substances: There are many pollutants of the ocean, and the major poisonous substances should be specially dealt with. When poisonous substances enter the sea they are extremely harmful to marine organisms and human health, and must be strictly controlled.

3. Major areas of the sea should be emphasized. The target of the marine environmental protection work is all seas, but the protection of some key areas should be stressed. The dumping of solid wastes into deepwater ports and navigation channels should absolutely be prohibited. Poorly-planned engineering structures should be prevented from causing silting and obstruction. The effluents of land-origin wastes should not be placed at marine products' breeding sites, coastal resort areas, natural preserves, etc. The discharge of waste water containing pathogens of infectious diseases and other poisonous substances, in particular, should be forbidden in order to preserve the clean quality of the water. Estuaries of important fishing areas should meet the "Fishery Water Quality Standard" requirements. This is the only way to have suitable environmental conditions for all activities involved in developing and utilizing the seas, so that the various marine resources may be reasonably developed and used in a manner of overall development of marine enterprises.

6248

CSO: 5000/4074

## TERMS IN LAW ON MARINE ENVIRONMENTAL PROTECTION EXPLAINED

Beijing RENMIN RIBAO in Chinese 25 Aug 82 p 3

[Article by National Bureau of Oceanography]

[Text] Natural Marine Preserve. To develop scientific research for the purpose of protecting the marine environment and its ecosystem, a particular area of the sea is demarcated for protection, this type of area is called a natural marine preserve. The state adopts effective measures with regard to the water, living organisms, and minerals within the natural marine preserve in order to protect the integrity of its natural resources. This is an important task in marine environmental protection work.

Self-Purification Capacity of Seawater. After pollutants have entered the sea, through the comprehensive action of the seawater, they will gradually decompose and will not pollute the marine environment. This ability of seawater to eliminate pollutants is called the self-purification ability of seawater. This ability is limited. When the quantity of harmful substances entering the sea exceeds a certain limit, the marine environment will be polluted.

Environmental Impact Statement. At the time of new construction, reconstruction, or expansion of marine engineering projects, the effect of the engineering project on the marine environment must be evaluated, and effective prevention and control measures should be proposed in accordance with the standard legal regulations concerning the marine environment. This type of written report is called an environmental impact statement. When the environmental impact statement is approved by the related departments, the engineering construction unit and its supervising department may then compile the planning responsibility documentation of the construction item. This is an important measure of marine environmental pollution prevention.

Eutrophication of Seawater. Due to the addition of waste water containing a large quantity of nutrients such as nitrogen, phosphorus, etc., the nutrients promote the growth and propagation of unicellular algae and protozoa in great quantities, causing the seawater to be anoxic. Fish and shellfish will die and the quality of the seawater will deteriorate. This type of phenomenon is called eutrophication of seawater. The major method of controlling eutrophication of seawater is to remove the nutrients from the waste water. Chemicals can also be used to control the multiplication of algae.



Semi-Enclosed Sea. Some areas of sea are encircled on two sides or more by land, leaving only one or a few narrow outlets to link with the open sea. This type of marine area is called a semi-enclosed sea. China's Bohai is this type of semi-enclosed sea. The self-purification capacity of the semi-enclosed sea is relatively poor and it can easily be polluted. More effective and strict measures should be adopted for the protection of such areas.

6248

CSO: 5000/4074

PROBLEMS OF DEVELOPMENT, ENVIRONMENTAL IMPACT ON SHIYANGHE VALLEY WATER RESOURCES

Beijing SHUILI SHUIDIAN JISHU [WATER CONSERVATION AND HYDROELECTRIC POWER TECHNOLOGY] No 7, 20 Jul 82 pp 21-26

[Article by Chen Hesheng [7115 5440 3932] of the Lanzhou Deserts Institute, Chinese Academy of Sciences: "Development of Shiyanghe Valley Water Resources and Its Environmental Impact"]

[Text] 1. Survey of the Development, Utilization and Transformation of Water Resources

The Shiyanghe valley is situated in the eastern part of the Hexi Corridor in Gansu Province and has a history of over 2,000 years of agriculture irrigation. It is a thriving and prosperous region along the old Silk Road. Of the three major inland river systems of the Hexi Corridor, the volume of water in the valley is comparatively less, whereas there is more land under cultivation. Its soil quality is also the best. The Qilian Mountains lie to the south of the valley, while the Tengger and Badan Jaran Deserts lie to the north. It is in an arid region in a cold zone. The area of the valley is 40,160 square kilometers. The 13 large and small tributaries in the valley have their origins in the Qilian Mountains and depend on rainfall and melted snow and ice in the Qilian Mountains for their water supply. After the river leaves the mountains, it enters the Wuwei Basin in the southern part of the corridor. Within the piedmont diluvial fan, there is a large volume of vertical infiltration and ground water supplementation. Because of changes in geological structure and hydrologic conditions, ground water in the form of spring water also seeps out to the earth's surface in large amounts along the shallow cut channel and is the principal source in the lower reaches of the river. Spring water and return water from irrigation flow along the river bed and irrigation ditches through the medium-height and low mountains between the northern and southern basins toward the Minqin Basin in the northern part of the corridor.

There is an inseparable relationship between the ground water and the surface water in this valley. From the upper to the lower reaches, the surface water and the ground water exhibit a rather distinctive pattern of repeated transformation as shown in Figure 1. After Liberation, and particularly since the 1970's, the establishment of water conservancy projects and the development of irrigation facilities have led to the occurrence of great changes in the pattern of water resources as can be seen from Tables 1 and 2 and Figure 2. In the 1950's,

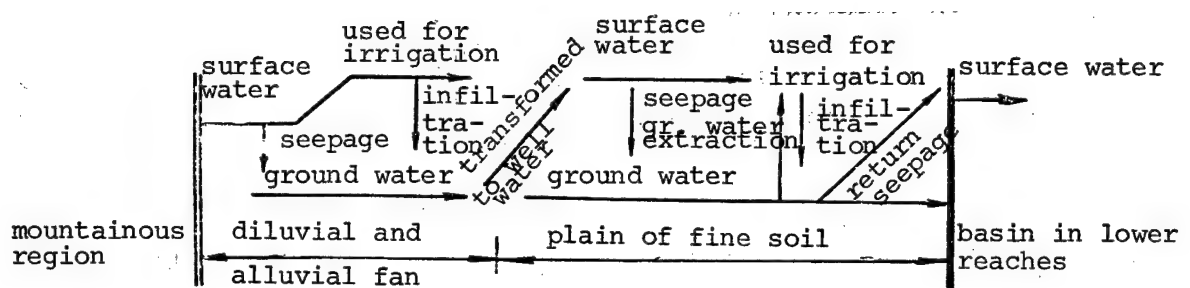


Figure 1. Schematic Diagram of Surface Water and Ground Water Circulation in the Shiyanghe Valley

Table 1. Conditions of Transformation of Surface Water and Ground Water in the Shiyanghe Valley

Item	Region Period	Wuwei Basin		Minqin Basin	
		1950's	1970's	1950's	1970's
Ratio of surface water transformed to ground water (percent)		70-80	50	80	50
Ratio of ground water seeping out as well water (percent)		80	40		

Table 3. Conditions of Development and Utilization of Water Resources in the Shiyanghe Valley

Item	River water volume	Spring water volume	Utilization ratio of canal system water	Effective area of irrigation	Area of maintained utilization
Unit	100 millions of meters <sup>3</sup>		Percent	10 thousands of mu	
Period					
1950's	15.59	6.50	0.25-0.30	242.0	103.7
1960's	13.03	4.97	0.35-0.45	309.4	172.2
1970's	12.13	3.20	0.45-0.68	318.5	218.4

Note: For area under irrigation, 1959 was taken as the representative year for the 1950's, 1969 was taken as the representative year for the 1960's and 1979 was taken as the representative year for the 1970's.

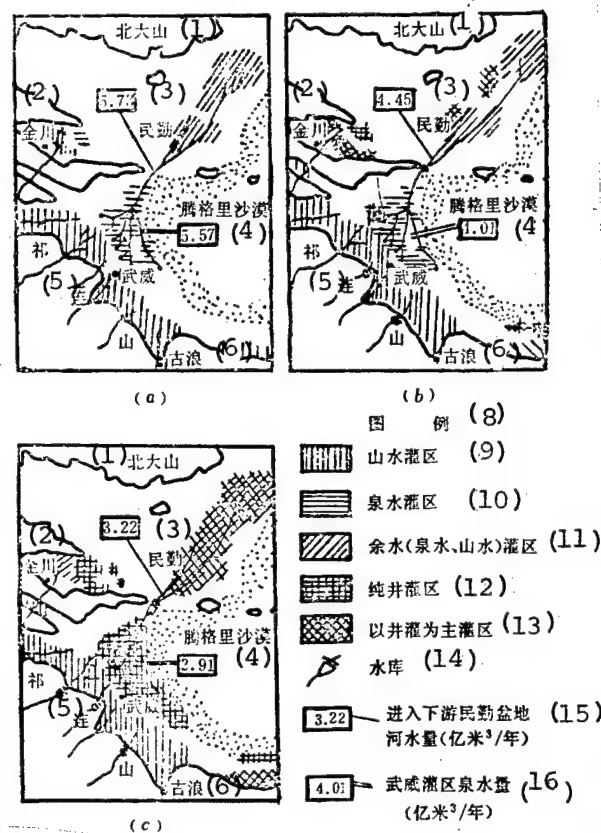


Figure 2. Evolution of Patterns of Utilization of Water Resources in the Shiyanghe<sup>3</sup>

(a) 1950's; (b) 1960's to early 1970's; (c) late 1970's

Key:

- |                                     |   |
|-------------------------------------|---|
| 1. Beida Mountains                  | 10. Spring water irrigation region  |
| 2. Jinchuan                         | 11. Surplus water (spring water, mountain water) irrigation region  |
| 3. Minqin                           | 12. Pure well irrigation region   |
| 4. Tenggeli Desert                  | 13. Irrigation region in which irrigation is primarily by wells   |
| 5. Qilian Mountains                 | 14. Reservoir   |
| 6. Guliang                          | 15. Volume of river water (100 million meters <sup>3</sup> /year) entering the Minquan Basin in the lower reaches |
| 7. Wuwei                            | 16. Volume of spring water in the Wuwei irrigation region (100 million meters <sup>3</sup> /year)                 |
| 8. Legend                           |   |
| 9. Mountain water irrigation region |   |

a relatively stable irrigation system was initially formed on the basis of the natural water system distribution. This system was divided into three irrigation groups consisting of mountain water, spring water and surplus water (river water and spring water). Four reservoirs were built and 2,260.6 kilometers of dry branch canals were reconstructed, with a canal system water utilization rate of 0.30 to 0.35. Thus, there is little concern over the lack of water. In the 1960's and 1970's, a reservoir was built in the mountain region and the standard of the irrigation channels was raised (939.6 kilometers of irrigation canal being lined). This raised the canal system water utilization rate to 0.35-0.45, expanded the area irrigated by mountain water, decreased spring water and resulted in a loss of water resources in the zones contiguous with the mountain water irrigation region and the spring water irrigation region, as a result, wells were dug to extract ground water. This was gradually extended, causing a water shortage in the surplus water irrigation region. In the middle and latter part of the 1970's, reservoirs were built in the valley in the mountainous region except in the case of the Dongda and Zamu Rivers. These reservoirs controlled over 70 percent of the surface run-off. The river water irrigation region was further expanded, with the canal system water utilization rate reaching 0.45-0.68. Large volumes of ground water were extracted in the middle reaches with the result that there were further decreases in spring water so that the spring water irrigation region became for the most part a well irrigation region. There was a rapid decrease in water resources in the surplus water irrigation region (the Minqin Basin) and the volume of ground water extracted amounted to more than 50 percent of the volume of water used for irrigation. At present, utilization of water resources in the Shiyanghe valley has reached a relatively high level, the total amount being used amounting to 1.65 times the total amount of water coming from the mountain rivers (see Table 3). The processes of transformation of the water resources are far more complicated than in the 1950's. The principal arena of transformation has changed from the natural river beds to interfield return, with the scope of transformation having been expanded, the levels of transformation having been increased and the process of transformation having been prolonged.

Table 3. Analysis of Water Resource Utilization in the Shiyanghe Valley in 1979

Volume of river water coming from the mountains (100 million meters <sup>3</sup> )	Volume of water utilized (100 million meters <sup>3</sup> )			Total amount utilized as percentage of volume of river water coming from the mountains (percent)
	Surface water	Ground water	Total	
14.29	13.78	9.77	23.55	164.8

In summary, the fact that most of the water conservancy construction over the past 30 years has been concentrated in the upper reaches has resulted in an increase in the amount of water used in the mountain water irrigation region and has brought about changes in the mode of utilization of ground water in the middle reaches, with most of the spring water irrigation district being replaced

by well irrigation. The volume of surface water in the irrigation region in the lower reaches has been reduced by half so that it has become necessary to develop well irrigation. This mode of development involving careful control in the upper reaches, extraction of excessive amounts in the middle reaches and imbalance in the allocation of water resources in the upper and lower reaches has led to a condition of gradual exhaustion of the water resources in the lower reaches. In addition, allocation of water resources in the lower reaches has also been controlled by artificial water systems in which the boundaries have been set on the basis of administrative districts. This has further aggravated the pattern of imbalance in the allocation of water resources.

## 2. Effects of the Development of Water Resources on the Environment

Water is a precious natural resource and is also a very important element in the environment. Regardless of whether it is natural or man-made factors that bring about changes in water resources, they will inevitably have corresponding effects on the environment, and, as development of water resources is intensified, will have continually greater effects on the environment.

### 1) The volume of spring water is continuously decreasing

The spring water zone in the Shiyanghe valley is distributed in an arch-shaped pattern in Wuwei County and Yongchang County. Since the 1950's, spring water has continually decreased. As can be seen from Table 4, there was a decrease of 72.35 percent in the amount of spring water in the valley as a whole in 1979 as compared to 1956, and, as can be seen from Figure 3, there was an extremely distinct decrease in spring water in Wuwei County in the 1970's. At the same time that there was a decrease in the amount of spring water, as can be seen from Tables 5 and 6, the position of the spring water zone shifted lower. The downward shift in the zone increased the breadth of the zone of deficient water between the mountain water irrigation region and the spring water irrigation zone, stimulating further development of well irrigation. As well irrigation was developed, many springs dried up one after the other. In Wuwei County alone, there are more than 230 dried-up spring channels; this amounts to 79 percent of the original spring channels. Table 7 shows the states of change in the numbers of wells and amount of water in the Yongchang irrigation region of Wuwei County.

Table 4. Changes in Spring Water in the Shiyanghe Valley

County or Region \ Year	1956	1966	1979
Wuwei County	4.689	2.674	0.86
Qinghe, Siba in Yongchang County	2.229	1.528	1.053
Totals	6.918	4.202	1.913

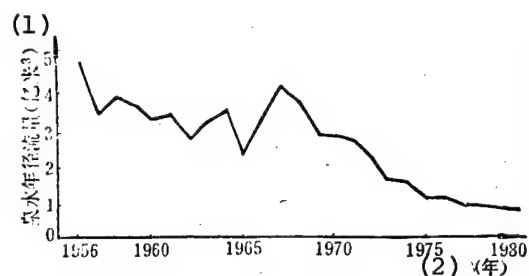


Figure 3. Curve of the Run-Off Process of Spring Water in Wuwei County

Key: 1. Annual amount of spring water run-off (100 million meters<sup>3</sup>)  
2. Year

Table 5. Distances of Downward Movement of the Spring Water Zone in Wuwei County

Position of appearance of zone	Hongshui River	Dasha and Xiaosha Rivers	Baita River	Haizhi River	Nansha River	Beisha River
Distance (km) of downward movement of zone of occurrence	2	7	5	1	2.5	2

Table 6. Distances of Downward Movement of the Spring Water Zone in Yongchang County

Position of appearance of zone	Siba River	Qinghe Dam	Maniu Dam	Meiqi Dam
Distance (km) of downward movement of zone of occurrence	1.5-2.0	3.0-3.5	2	0.5

Table 7. Changes in Numbers of Springs and Volumes of Water in the Yongchang Irrigation Region in Wuwei County

Item	Year	1963	1974	1975	1978	1979	1980
Springs (sites)		103	22	22	20	17	16
Spring water flow volume (m <sup>3</sup> /second)		5.2	1.09	0.59	0.27	0.28	0.19

## 2) Regional drops in the ground water level

A total of eight well irrigation districts were built in the valley. The pure well irrigation area is about 790,000 mu, with about 530 million cubic meters of water being extracted in a year. The area irrigated primarily by wells is about 850,000 mu, with about 350 million cubic meters of water being extracted. This excess extraction of ground water has caused drops in the ground water level. As the result of a survey in which the present ground water level was compared to that in 1959, the alluvial and diluvial fan group zone in the southern part of the Wuwei Basin has generally dropped 10 to 20 meters, while the zone of spring occurrence has dropped 1 to 5 meters. The Ba region in the northern Minqin Basin has dropped 4.55 meters, the Quanshan region has dropped 4.4 meters and the lake region, which is farthest to the north, has dropped 2 meters. What has drawn particular attention is the fact that the rate of drop has gradually increased. Table 8 shows the extent of drop in the ground water level in the Minqin Basin since 1973 and Figure 4 shows the trend toward drop in the ground water level since 1973 in Well No 94 in Minqin County.

Table 8. Extent of Drop in Ground Water Levels in the Minqin Basin from 1973 to 1979

Year	1973- 1974	1974- 1975	1975- 1976	1976- 1977	1977- 1978	1978- 1979
Extent of drop (m)	0.4	0.5	0.65	0.75	0.85	0.9

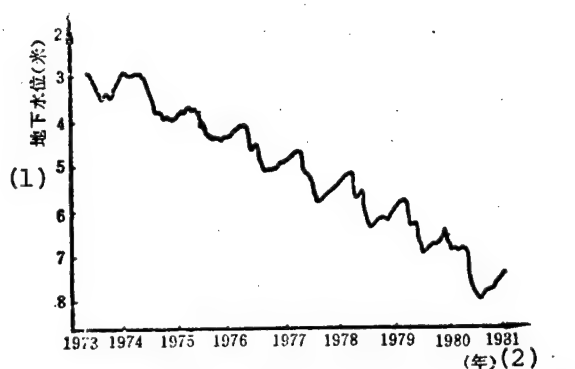


Figure 4. Curve of Process of Drop in the Ground Water Level of Well No 94 in Minqin County

Key: 1. Annual volume of spring water run-off (100 million meters<sup>3</sup>)  
2. Year

3) Sudden decrease in water resources in the Minqin Basin in the lower reaches and its consequences

The surface run-off in the Minqin Basin in the lower reaches of the Shiyanghe is supplied from three areas: return and emergence of infiltrated water in



irrigation regions in the upper and middle reaches; surplus water that leaked down in spring water regions during winter when irrigation was not being carried out; and floodwater, primarily floodwater in the mountainous regions in the upper reaches, and secondarily, floodwater from rainstorms between regions in piedmont areas. As water conservancy projects were built, the capacity to control surface run-off has been strengthened, the amount of canal system infiltration has been strengthened, the amount of canal system infiltration has decreased, the amount of water used in irrigation has increased and ground water in the middle reaches has been extracted. As a result, there has been a gradual decrease in the amount of water emptying into the Minqin Basin. As can be seen from Figure 2, the average in the 1950's was 570 million meters<sup>3</sup>/year, the average in the 1960's was 445 million meters<sup>3</sup>/year and the average in the 1970's was 322 million meters<sup>3</sup>/year, a decrease of 43.8 percent by the 1970's as compared to the 1950's. The decrease in water coming from the upper reaches has brought about changes in the ecological environment in the Minqin oasis which have affected agricultural production and the people's livelihood.

#### (1) Deterioration in the conditions of agricultural production

There are over 1 million mu of cultivated land in Minquan County about 800,000 mu are actually being planted. The area maintained under irrigation is about 560,000 mu. Because of the lack of water, 275,000 mu of cultivated land in the northern lake region have been changed to staggered planting or have been withdrawn from cultivation. Farmland that has been withdrawn from cultivation does not have a vegetation cover, and under arid climatic conditions undergoes severe wind erosion. In the southern Ba region, there is close to 300,000 mu of farmland in nine communes in which, in addition to the water for planting, the seedlings used to be irrigated twice with river water. After 1974, there was not only insufficient river water to meet the needs for irrigating the seedlings but there was also only enough water to meet 65 percent of that required for planting, the remainder had to be supplemented by well irrigation. In the northern lake region, the ground water level was previously comparatively high, with river water being used only once a year for the purpose of planting the seeds. The ground water level has dropped, and in addition to water for planting the seedlings have to be irrigated two or three times a year in order to obtain a basic harvest.

#### (2) Destruction of sand-fixation plants and intensification of the process of desert formation

The Minquan basin region is a desert hinterland, with oases accounting for 9 percent of the area of the county as a whole and with desert accounting for 82 percent of the area of the county as a whole. The forests and vegetation surrounding and within the oases are the bases and definitive conditions for withstanding wind-blown sand and maintaining the stability of the oases. Because of the decrease in the amount of water emptying into the basin and because of extraction of ground water, the soil dried out. This led to the decline and destruction of the vegetation over a wide area. In Minqin County, there was originally 630,000 mu of man-made forest of which about 70 percent was narrow-leaved oleaster resistant to dry conditions. However, this is a species of tree with shallow roots that is adapted to growing under conditions of a ground water

level of 2 to 3 meters. At present, 44,000 mu of narrow-leaved oleander and willows have died and there are 87,000 mu on which there are withered branches. (See Table 9) In addition, there are varying degrees of decline. The natural white thorn, red willow and aster that surround the oases and that have been succeeding each other for several generations could not obtain sufficient water and because of destruction caused by man about 67.6 percent of the area is in a state of regression. (See Table 10) Sand dunes have also become activated in all areas in which the vegetation has been destroyed. In the light of the conditions of ecological balance in this region, once the original vegetation has been destroyed, recovery will be extremely difficult. If present conditions continue, the consequences will be intolerable.

Table 9. Destruction and Withered Branches Among Man-Made Forests of Narrow-Leaved Oleander and Willows

Destruction		Withered branches	
Area (10,000's of mu)	Number of trees (10,000's of trees)	Area (10,000's of mu)	Number of trees (10,000's of trees)
4.46	215.20	8.73	706.58

Table 10. Changes in White Thorn, Red Willow and Aster in the Peripheries of Minqin Oases

Total area 10,000's of mu	Preserved area		Area of regression		Area changed to desert	
	Area (10,000 mu)	Percent of total area	Area (10,000 mu)	Percent of total area	Area (10,000 mu)	Percent of total area
108.63	35.07	32.28	54.57	50.23	18.99	17.49

Note: Cases in which the degree of cover was 0.4 or greater were considered instances of preserved area. Cases in which the degree of cover was 0.3 or less were considered to be instances of area of regression and cases in which the degree of cover was less than 0.1 were considered instances of area changed to desert.

### (3) Deterioration in the quality of ground water and decrease in usable water

The terrain of the Minqin Basin is flat without dissection. Movement of the ground water level is very sluggish. It is both deeply buried and shallow and there is intense evaporation. Historically, there has been a problem of accumulation of salt in the ground water. Under conditions in which ground water has been extracted in excessively large amounts and used repeatedly and in which there has been a sharp decrease in the supply of fresh water in the upper reaches, the water has become further concentrated and mineralized. Within the

layer of extraction (within 60 meters), the degree of mineralization of the ground water increases at a rate of 0.2 grams/liter each year. In the Hongshaliang zone (which is of about 40 square kilometers) in the central Quanshan region, the degree of mineralization of the ground water has risen from 2.0 grams/liter to 3.0 grams/liter. At present, there is an area of oases of about 331,000 mu, or 35 percent of total area of cultivated land, in which the values for the water are greater than 4 grams/liter. Mineralization of the water has resulted in a decrease in the quantity of usable water in the basin, has aggravated the contradiction between supply and demand and has created a vicious cycle.

(4) Use of highly mineralized water for irrigation, extension of the area of saline-alkaline soil and hardening of the soil

The factors that caused the oases determined the fact that the parent material of the soil would have a comparatively high salt content. Before the 1960's, the ground water level was high. The phreatic water evaporated, leaving an accumulation of salt and bringing about salinization of the soil. Since the 1970's, the drop in the ground water level has been advantageous for removing salt from the body of the soil and there should be some alleviation of salinization. However, because of the water shortage, people have been compelled to use salt water with a degree of mineralization of over 4 grams/liter. Because of the accumulation of salt due to evaporation of the phreatic water, this has caused the salt that has accumulated in the body of the soil to change for the most part into accumulated salt in bodies of soil in which highly mineralized water carries salt residues, with the salinized area progressively expanding. (See Table 11)

Table 11. Changes in the Area of Saline-Alkaline Soil in the Lake Region of Minqin

Area	1958	1963	1978
Area of cultivated land (10,000's of mu)	45.18	42.34	40.22
Area of old saline-alkaline soil (10,000's of mu)	15.81	12.26	19.40
Area of new saline-alkaline soil (10,000's of mu)		6.12	13.7
Proportion of saline-alkaline soil to cultivated land	35	43	82.3

The percentage of the area of saline-alkaline soil in the Lake region of Minqin to the total area of cultivated land increased from 35 percent in 1958 to 82.3 percent in 1978. In the past, the Dongzhen Commune handed over grain to the state; however, in 1979, the state resold 840,000 jin to it.

The  $\text{Na}^+$  content in bitter water with a high degree of mineralization is high, and this can cause a colloidal dispersion of the soil, with the result that the pores become stopped up and the permeability is decreased. This in turn can

reduce the rate of salt removal during irrigation so that the soil gradually hardens and becomes solid. Lumps of earth are then generally hard to smash using a wooden hammer, and this makes it difficult to process the soil and makes its suitability for cultivation ever poorer.

#### (5) Effects on the livelihood of the masses

A decrease in the amount of freshwater coming from the upper reaches and drops in the ground water level makes it difficult for people and domestic animals in the Minqin Basin to obtain drinking water. In the past, the masses relied primarily on shallow freshwater water sources. At present, these have been used up and people have been forced to use highly mineralized drinking water. This has had serious effects on the physical and mental health of the people. Today, there are 757,000 people and 376,000 large domestic animals in 98 production brigades of 12 communes in the northern part of the basin for which the problem of drinking water must be solved on an urgent basis.

The Minqin Basin was originally an irrigation region in which surface water was primarily used. It has now changed into an irrigation region based primarily on well irrigation. The original network of canals for supplying surface water has been maintained but the utilization rate is very low. A new well irrigation system has been built. The mode of the wells has been changed three times in 10 years (Yachai Well: inland well → boiler well → blast well) and the equipment was changed four times (dual tube waterwheel → diesel engine pump → electric centrifugal pump → phreatic pump). This consumed large amounts of capital of the state and of the collectives. Under present conditions, the costs of irrigation are 2.5-3.0 yuan per mu for planting, 0.5-0.8 yuan per mu for watering seedlings and 6 to 12 yuan per mu for the entire year. The cost per mu for grain production for the county as a whole rose from 3.49 yuan in 1965 to 33.58 yuan in 1979 and the cost per jin rose from 0.0236 yuan in 1965 to 0.093 yuan in 1979. From the standpoint of total agricultural, there was a comparatively large increase. However, because of an increase in expenditures, there was not a change in net income. Because of increase in population, there was a decrease in the daily value of labor so that the actual incomes of the commune members have increased very slowly.

### 3. Ways To Control and Reverse Deterioration of the Environment

The development and utilization of water resources has led to deterioration of the natural environment. The following aspects should be considered in regard to measures for control and reversal of this deterioration.

#### 1) Active expansion of water and soil conservation work

##### (1) Safeguarding and establishing water resource forests in the Qilian Mountains

The Qilian Mountains are the region in which the water resources of the Shiyanghe valley are formed. They have an elevation of 2,700 to 4,000 meters. From bottom to top there is a distribution of natural shrubs and woods, grasslands, alpine forests and alpine grassy marshland. They have great significance for the ecological balance between the conserved water resources and the valley as a whole.

A water conservation forest is a natural green reservoir and plays a major role in reducing floodwater pressure on reservoirs, in extending the life of reservoirs and in regulating allocation of annual run-off within the year. Since Liberation, there have been gradual annual increases in the population in the mountainous region, with the population increasing from 90,000 people in the 1950's to 260,000 people today. This had increased the burden on the mountainous region and has led to excessive cutting, with forests being destroyed and wasteland being opened, with the result that about 10 percent of 3.4 million mu of natural forest has suffered varying degrees of damage. Of this amount, 120,000 mu has been severely damaged. There has also been damage of the aln shrub groves. Opening up of grasslands has been particularly prominent, with over 800,000 mu having been opened up over the past 10 years. Destruction of forests and grasslands has led to loss of water and soil erosion and a decrease in the amount of run-off. The measures that are now being taken to safeguard and build water conservation forests are not premature and will also provide a definite basis for the natural ecological environment. The sources of forest cover still exist and the water component of the soil is good so that recovery will be comparatively easy.

(2) Reduction of cultivated land, conversion of fields for grazing and conservation of water and soil in hilly regions

The hilly and mountainous region is situated in the piedmont zone of the Qilian Mountains and has elevations between 2,000 and 2,500 meters. This is a zone in which there is an interlacing of grassland cover and shrub groves. The population in this region accounts for over 20 percent of the population of the valley as a whole. Historically, it has been a grazing region. As the population increased, it was gradually converted from grazing land to farm land so that agriculture is now dominant. Because a large area was opened up, there has been severe regression and destruction of the plant cover and severe water and soil erosion. This directly threatens the safety of the reservoirs and the number of years they can be used. Since the Nanying Reservoir in Wuwei County was built in 1969, there has been an accumulation of 4.76 million cubic meters of silt. This amounts to 34.4 percent of the effective capacity of the reservoir. In 1960, the Caojia Lake Reservoir was built in Gulian County and had an effective designed capacity of 5.52 million cubic meters, the dead storage was 50,000 cubic meters. By 1975, the volume of silt accumulation amounted to 1.5 million cubic meters. As a result, it was necessary to readjust the structure and management direction of agriculture and animal husbandry in the region. The area under cultivation was reduced, farm fields were converted to grazing land, hill-sides were closed to facilitate the growing of grass and a great effort was made to put water and soil conservation measures into effect. If there is the possibility, consideration can also be given to dispersing the population in order to lessen the pressure on the hilly region.

2) Effecting integrated management and rational utilization of the water resources of the entire valley

The implementation of water control, water management, use of water and allocation of valley water resources on the basis of administrative divisions over the years has not been based on natural laws and economic laws and has created

imbalances in the allocation of water resources. In the area of water resource management, only surface water has been managed, while ground water has not been managed. Thus, the amounts of ground water that can be extracted and the amounts that are actually extracted are not clear so that water use has been in a state of anarchy. When ground water has been extracted, no consideration has been given to decrease in the supply of ground water, and when ground water has been exploited, no consideration has been given to its effects on surface water. In the upper and middle reaches, there has been a comparatively high degree of development of irrigation and use of large amounts of water without taking into consideration the consequences of decrease in water resources in the Minqin valley. For this reason, integrated regulations, development and management should be implemented within the sphere of the valley as a whole. If it is possible, a water resources committee for the valley as a whole should be established as soon as possible. Its tasks should be as follows: 1) Ascertain water resources and do a good job of water conservancy planning for the valley as a whole. 2) Get a firm grasp on management, integrate allocation of the amounts of water used in the upper and lower reaches and exercise strict control over the amount of ground water extracted and particularly over the amount of ground water extracted in the middle reaches. 3) Conduct research on measures for controlling and reversing deterioration of the environment in the Minqin Basin in the lower reaches.

The upper and lower reaches of the valley constitute a natural environmental entity. The Minqin oasis in the lower reaches lies along the desert, and as far as Wuwei County is concerned, they are closely related and mutually dependent. If the Minqin oasis is not maintained, the present relative state of stability of agricultural ecology in Wuwei would be destroyed. Therefore, we should give consideration to saving about 40 million cubic meters of the water used in Wuwei County and transferring it into the Minqin Basin in order to maintain the amount of water entering the Minqin Basin at its average level in the 1970's, i.e., 310 million to 320 million cubic meters. This should be combined with readjustment of the cultivated land in the Minqin Basin, decrease in the amount of ground water extracted and control to prevent further deterioration of the ecological environment in the Minqin Basin.

### 3) Measures for saving on the amount of water use

In terms of the present actual state of water use, there is excess extraction of about 300 million cubic meters of ground water in the valley as a whole each year. For this reason, it is essential to adopt measures for economizing on water use in order to facilitate balance between soil and water.

#### (1) Regulating the proportions of summer and autumn crops

At present, summer-harvested crops account for about 80 percent of the crops that are planted in the valley. There is a fairly low amount of rainfall from April to June, which is the principal growing period for the summer-harvested crops. Therefore, the water supply is dependent primarily on irrigation, the amount of water required by irrigation being about 360 million cubic meters. However, the average annual water supply is only 227 million cubic meters (which is 62.9 percent of the amount of water required). In a moderately dry year, it

is only 172 million cubic meters (which is 47.6 percent of the amount of water required). In spite of the fact that there is water stored in the reservoir, there is still a contradiction between supply and demand. If the proportion of autumn-harvested crops were increased suitably in relation to the comparatively high rainfall in July to September in the valley, this would be definitely effective in decreasing the amount of irrigation water. It would be suitable to control the proportion of summer-harvested crops to about 65 percent.

## (2) Extension of an advanced irrigation system

The irrigation quota at present for the valley as a whole is about 800-1,100 meters<sup>3</sup>/mu, a comparatively great consumption of water. On the basis of experimental data over a period of several years from the Wuwei and Minqin experimental stations (see Table 12), the wheat irrigation quota has been 400-420 meters<sup>3</sup>/mu, with which yields of 700-800 jin per mu can be obtained. On the basis of analyses of the experimental data, there are close relationships between the duration of irrigation, the frequency of irrigation and the amount of water used in irrigation on the one hand and increase in water-saving on the other hand so that there is a comparatively great latent capacity for economizing on water.

Table 12. Experimental Data on Spring Wheat Irrigation in Minqin County

Name of county	Number of irrigations and amounts of water (meters <sup>3</sup> /mu)						Irrigation quota (meters <sup>3</sup> /mu)	Production yield (jin/mu)
	Irrigation with reserve water	1	2	3	4	5		
Wuwei	120	55	60	50	65	70	420	700-800
Minqin	150	50	45	60	59	45	400	800

## (3) Reforming irrigation techniques

Irrigation techniques in the valley as a whole are backward, with the area under furrow-channeling irrigation and flood irrigation amounting to more than half the total area under irrigation. Of this, the area under furrow-channeling and flood irrigation in Yongcheng County amounts to 89.4 percent of the total area under irrigation. In Wuwei County, in which there has been improvement in irrigation methods, the border method of irrigation is used in 37 percent of the total area under irrigation (see Table 13). If, in the future, thorough reform is made of the backward methods of furrow-channeling irrigation and flood irrigation and the methods of furrow and border irrigation are extended, then it may be possible to make savings of 20 to 30 percent in water.

The magnitude of the area of the massif and its levelness are also related to the amount of irrigation water. The larger the area of the massif, the greater the frequency of the irrigation per mu (see Table 14). At present, furrow-channelling irrigation of the large massif is generally used to a great extent throughout the entire valley. In the river water irrigation region, most of the massifs that are irrigated are on the order of 2 to 3 mu. If they were suitably reduced in size and leveled, this could also be a way of economizing on water use.



Table 13. Areas of Irrigation in the Shiyanghe Valley Under Different Methods of Irrigation

Name of county	Furrow border irrigation		Plot irrigation		Furrowed-channeling irrigation		Remarks
	Area (10,000's of mu)	Percent of total area	Area (10'000's of mu)	Percent of total area	Area (10,000's of mu)	Percent of total area	
Wuwei	51.55	37	43.47	31	44.4	32	Spray irrigation on 64,000 mu, or 25.5 percent of total
Yongchang	5.8	8.9	1.12	1.7	58.66	89.4	
Guliang	2.7	10.8			16	63.7	

Table 14. Relationship Between Amount of Irrigation Water and Massif

Massif area (mu)	10	5	1	0.5
Amount of irrigation water per mu (meters <sup>3</sup> )	150	130	70-80	50-60

#### 4) Limiting population growth and regulating water throughout the valley

The rapid increase in population has also been a basic factor in creating a crisis in water use and in bringing about changes in the environment. For example, the population in the mountainous region in the 1950's was only 90,000 people, whereas by the 1970's it had increased to 260,000 people. Opening up land for cultivation by destroying forests was an inevitable consequence of this. In the hilly region, the increase in population led to abandonment of grazing for farming. The population in the Minqin oasis has reached 240,000. This has been the cause of the excessive extraction of ground water. For this reason, strict control of the rate of population growth is a long-term strategic measure for controlling changes in the ecological environment.

At present, development and utilization of the water resources as a whole has reached a point of saturation. In order to satisfy the needs of the continually growing population and to assure stable development of industrial and agricultural production as well as to achieve a basic solution to the problem of environmental deterioration in the Minqin Basin, it will be essential to consider bringing in water from outside valleys, for example, introducing Yellow River water (Jingdian [2529 7193] second stage project) and Qinghai Canal (Yin da-ji xi [1714 1129 3444 6007] project). Good planning work must be done in order to achieve realization as soon as possible.

## ARTICLE EASES FEARS THAT THE CHANG JIANG WILL BECOME AS SILTED AS THE HUANG HE

Beijing DILI ZHISHI [GEOGRAPHICAL KNOWLEDGE] in Chinese, No 5, May 82, pp 3-5

[Article by Zhou Wenhao [0719 2429 3185] and Fan Zhao [5400 2507]: "There Is no Danger That the Chang Jiang Will Become Another Huanghe"]

[Text] For a long time, people along some of the branches in the middle and upper reaches of the Chang Jiang have felled forests at will and reclaimed slopes, causing the destruction of forest resources and the loss of water and soil erosion. This should attract our serious attention. During the past 2 years, some comrades have proposed strengthening water and soil retention in the middle and upper reaches of the Chang Jiang, protecting and expanding forest resources and nurturing the Chang Jiang's water sources, this is correct. But some comrades believe that "there is indeed a danger that the Chang Jiang will become another Huang He," this view is worth discussion. When we say that the Chang Jiang will become another Huang He, we mean that the amount of mud and sand in the Chang Jiang will become as much as in the Huang He while the amount of water will become as little as that in Huang He. Will the Chang Jiang become another Huang He? We can analyze this question by studying the conditions of the river valleys of Chang Jiang and the Huang He and the variation in the amount of sand in the Chang Jiang over the past 30 years.

### The Conditions of the River Valleys of the Huang He and the Chang Jiang Are Entirely Different

A river is characterized by the conditions of its river valley. The conditions of the river valley means the geographic, geological, and meteorological conditions within the river valley and the conditions of vegetation and coverage formed by them. Because the conditions of river valleys differ, every river has its own characteristics. The main characteristics of the river valley of the Huang He are: (1) There are wide and continuous expanses of loess in the middle and upper reaches covering an area of 430,000 square kilometers, constituting 60 percent of the area of the middle and upper reaches. This is the fundamental characteristic of the Huang He River Valley. Loess is loose in texture, it contains pulverized sand and loam

clay. Agglomeration of granules depends mainly on calcium carbonate which dissolves easily in rainwater. Therefore, loess has a poor ability to resist erosion. (2) Rain is scarce but torrential rains are concentrated. The average annual rainfall in the river valley is less than 400 millimeters and even in the valleys of the branch rivers of Yiluo and Xin He, where there is more rain, the annual amount of rainfall is only 500 to 700 millimeters. The dry climate makes for poor conditions for vegetation in the river valley. But in the Huang He River Valley, especially in the loess plateau regions, rainfall is concentrated, there are torrential rains in July and August, and the amount of rainfall in one or two days can reach 100 to 150 millimeters. The intensity of torrential rains of short duration can reach 200 millimeters. These basic characteristics have caused serious soil erosion in the middle and upper reaches of the Huang He. The modulus of soil erosion in some regions reaches 10,000 tons/square kilometers/year. Serious soil erosion has caused a network of ravines and barren mountain tops to emerge in the loess region. The massive amounts of mud and sand from erosion are carried by torrential rains and flood waters down the slopes into the branches and the trunk river, making the Huang He the world's carrier of silt. Each year, 1.6 billion tons of mud and sand enter the river channels in the lower reaches, and every cubic meter of water contains 40 kilograms of mud and sand, with the highest reaching 911 kilograms. But the volume of water in the Huang He is not great--only 40 billion cubic meters of water a year--and is smaller even than the Min Jiang, which has a river valley only one-thirteenth the area of the Huang He River Valley. The Huang He has less water and more sand. This is the characteristic of the Huang He determined by the conditions of the Huang He River Valley. The abundance of sand and the lesser amount of water in the Huang He did not begin recently. According to historical records, during the Qin and Han periods, and even earlier during the Western Zhou Dynasty and the period of the Warring States, the main area of soil erosion at the middle reaches of the Huang He was almost entirely covered by forests, but at that time, the Huang He had already become a river of a lot of mud and sand. During the Han Dynasty, Zhang Rong defined the Huang He as "a river with turbid water, it can be described as having six dou of mud in one dan of water."

The first characteristic of the Chang Jiang river valley is that it does not have a broad loess region. The areas scattered in the upper reaches with a modulus of soil erosion larger than 1,000 tons/square kilometers/year constitute only 8 percent of the area and they are mostly areas of weathered rocks. Second, rainfall is abundant, the average annual rainfall in most regions is 1,000 to 1,500 millimeters. With a mild climate, plants easily grow in the Chang Jiang River Valley and vegetation is good. These characteristics enable the Chang Jiang to have a lot of water. Each year, the volume of water in the Chang Jiang is almost ten times (Yichang station) or twenty times (Datong station) that in the Huang He. The Chang Jiang does not have a lot of mud and sand. Each year, 540 million tons of mud and sand enters the river channels of the middle and lower reaches (Yichang). Every cubic meter of water contains an average of only 1.17 kilograms of mud and sand. The abundance of water and the lesser amount of sand are the characteristics of the Chang Jiang determined by the conditions of the Chang Jiang River Valley.

## Forecasting Changes in the Conditions of the Chang Jiang River Valley

In order for the Chang Jiang to become another Huang He, we must study whether the conditions of the Chang Jiang River Valley will become the same as those of the Huang He River Valley. Obviously, in the foreseeable future, this change will not occur, because:

(1) Geographic and geological conditions will not change. The soil and rock mountain areas are widely distributed in the middle and upper reaches of the Chang Jiang the ground surface is generally covered by a soil layer with a better viscosity. Although some rocks have weathered to varying degrees, obviously it is not possible within a fairly long historical period to change these weathered substances into loess. Therefore, in view of the source of silt, the content of sand in each cubic meter of water of the Chang Jiang will never increase by 40 times to reach the content of sand in the water of the Huang He. If the content of sand in the water of the Chang Jiang at Yichang reaches the same amount as that in the water of the Huang He, then each year, more than 16 billion tons of mud and sand would have to flow into the river. This is difficult to imagine.

(2) Weather conditions will not change. The weather in the Chang Jiang River Valley is like that in other areas of China. It not only is affected by the East Asian atmospheric circulation, it is also closely related to the circulation of the southern hemisphere, mainly the circulation over the southern Indian Ocean, the South Pacific and Australia. Every summer and autumn, the subtropical high pressure over the Pacific and the high pressure over the Indian Ocean intensify. The Chang Jiang River Valley is dominated by the southeast and the southwest monsoon, rainfall increases. In winter and spring, the weather of the Chang Jiang River Valley is dominated by the flow of cold air from the north, it is dry and there is less rain. Although such a pattern of change in atmospheric circulation varies from year to year, there is a cyclic change over a long period, and the annual amounts of rainfall over the Chang Jiang River Valley differ and the weather over a long period undergoes cyclic changes. In the foreseeable future, the weather over the Chang Jiang River Valley will still be dominated by the pattern of atmospheric circulation described above, it will not be easily affected by human activity. Some comrades believe that the reduction in the area of forests in the middle and upper reaches of the Chang Jiang during the past dozen years has caused climatic changes, thus causing changes in the amount of water in the river channel and annual distribution. This may be possible for some small river valleys, but on the whole, there is still no evidence. We analyzed nearly 40 years of hydrological data of the Min Jiang. The area of forests in the Minjiang river valley has drastically reduced, the proportion of coverage dropped from 28 percent to 13 percent. The average annual amount of water during the 1940s at Zipingpu Station was 14.1 billion cubic meters, during the 1950s and 1960s it was 15.1 billion cubic meters, during the 1970s it was 13.7 billion cubic meters. Except for the 1970s, the average annual amount of water did not change much. At this station, the amount of water during the flooding period in the 1940s constituted 77.7 percent of the annual amount; during the 1950s, it constituted 78.4 percent; during the 1960s, it constituted 79.1 percent, and during the 1970s, it

constituted 78.6 percent. The annual variation in the amount of water was not much. This situation also exists in the river valleys of the tributaries of the Minjiang, the Dadu He River Valley, the Heishui He and the Duogunao He. Therefore, we cannot see any effect upon the amount of water and its annual distribution caused by the reduction in the Min Jiang forests. The reduction in the amount of water during the 1970s not only exists in the Min Jiang but also in most of China's rivers such as the Huang He and the Wei He. This is obviously caused by the characteristics of atmospheric circulation during the 1970s, it cannot be explained by changes in forest coverage.

(3) The pattern of plant growth will not change. The weather characteristics of the Chang Jiang River Valley, even in the middle and upper reaches of the Chang Jiang, are very favorable for the growth of plants. Therefore, grass and trees grow well and propagate in the Chang Jiang River Valley. Even in some forest regions, vegetation can recover relatively quickly after trees have been felled. According to field studies by concerned units, after felling forests, it is entirely possible to restore the forest areas within 20 to 30 years by careful nurturing and by artificial methods. Before these forests are restored, some shrubs and weeds can grow very easily. Thirty to sixty percent of vegetation on the ground surface can be restored within a year of felling the forests, and 80 to 90 percent can be restored after 2 to 3 years. This is very favorable to retaining water and soil. Therefore, except for a small area of serious erosion, as long as weather conditions do not change, the Chang Jiang River Valley will not become like the Huang He River Valley with barren mountains.

#### Trends in the Variation of Mud and Sand in the Mainstream and Tributaries of the Chang Jiang

Whether the amount of mud and sand in the mainstream and tributaries of the Chang Jiang over the past several decades has increased or decreased is a debatable question. We analyzed the average amount of water, the amount of sand transported and the content of sand (i.e., the weight of mud and sand contained in one cubic meter of water) over the years recorded at 48 hydrological stations on the mainstream of the Chang Jiang and 22 tributaries since liberation. As shown in the table, the amount of water in the upper, middle and lower reaches of the mainstream of the Chang Jiang has dropped from that in 1958, but the average amount of sand transported and the content of sand over many years have increased only in 1958-1959 and during the 1960s at the stations below Yichang. In the 1970s, the amount of sand transported and the content of sand increased only at the Luoshan and Hankou stations because Zaiwan on the Jin Jiang reduced its distribution of sand into the Dongtinghu (estimated to be 54 million tons a year), the amount of sand transported and the content of sand at the other stations all dropped from those in 1958. This means, at present, the amount of mud and sand in the mainstream of the Chang Jiang has not increased since 1958. In addition, torrential rains in the river valleys of the Jialing Jiang and the Min Jiang in Sichuan caused damage and brought about the large flood in the middle reaches of the Chang Jiang in 1981 but the annual amount of sand

### Statistical Table on the Changes of Water and Sand at the Main Stations Along the Trunk River of the Chang Jiang

Name of River	Name of Station	Increase or decrease % in 1958-59 compared to period before 1958			Increase or decrease % in 1960-69 compared to period before 1958			Increase or decrease % in 1970-78 compared to period before 1958			Increase or decrease % in 1970-78 compared to the 1960s		
		Amount of water	Amount of sand transported	Content of sand	Amount of water	Amount of sand transported	Content of sand	Amount of water	Amount of sand transported	Content of sand	Amount of water	Amount of sand transported	Content of sand
Jinsha Jiang	Pingshan	-25.3	-20.5	+ 6.3	-8.3	-13.7	- 5.8	-18.9	-22.5	- 4.0	-11.6	-10.1	+ 1.8
	Zhujiatuo	-10.1	-10.3	- 0.9	+5.7	+ 7.8	+ 1.8	- 6.7	-14.4	- 8.5	-11.8	-20.6	-10.1
Chang Jiang	Cuntan	-15.3	-18.5	- 4.1	-0.6	-12.8	-12.1	- 5.7	-27.0	-22.8	- 5.2	-16.3	-12.2
	Yichang	-14.6	+ 8.8	+28.3	-0.7	+12.9	+14.2	- 9.3	- 3.9	+ 6.6	- 8.7	-14.9	- 6.6
	Luoshan	-14.3	+15.8	+30.9	-5.7	+22.1	+24.3	- 9.0	+28.7	+37.0	+ 3.5	- 5.4	+10.3
	Hankou	-15.0	+17.0	+38.0	-5.1	+24.1	+30.4	- 8.3	+ 9.0	+18.6	- 3.4	-12.2	- 9.1
	Datong	-15.2	+ 3.6	+16.4	-9.1	+ 8.8	+13.7	-10.4	-10.0	- 4.3	- 1.5	-17.3	-15.9

transported and the average content of sand at the Yichang Station did not surpass the levels of 1958-1959.

The amount of sand transported and the content of sand increased in the eight tributaries of the Min Jiang, Jialing Jiang, Xiang Jiang and its branches Liulai Shui, Die Shui, the middle and upper reaches of the Hanjiang, the lower reaches of the Ganjiang in 1958-1959 compared to the period before 1958. The amounts increased the most in the Minjiang and the middle and upper reaches of the Jialingjiang. For example, the amount of sand transported and the content of sand at the Pengshan Station on the Minjiang increased 280 percent and 240 percent respectively. During the 1960s, the amount of sand transported and the content of sand increased in the Yalong Jiang, Min Jiang, the middle and upper reaches of the Jialing Jiang, Tuo Jiang, Pei Jiang, Xiang Jiang and its branches, the Liulai Shui, Die Shui, and the lower reaches of the Gan Jiang, totalling 9 branch rivers. The amounts in the Min Jiang and Jialing Jiang increased more. The amount of sand transported and the content of sand at Pengshan Station respectively increased by more than 150 percent. During the 1970s, the amount of sand transported and the content of sand increased, in the six branches rivers of the Min Jiang, the upper reaches of the Tuo Jiang, Wu Jiang, Xiang Jiang and Xin Jiang. The increases were the most obvious in the Wu Jiang. The amount of sand transported and the content of sand all increased by more than 10 to 20 percent in the upper, middle and lower reaches.

It can be seen from this that the change in the amount of mud and sand during each period in each of the tributaries is different, increases in mud and sand occurs only in some tributaries.

Currently, the debate over changes in the amount of mud and sand over the past several decades in the Chang Jiang is mainly due to the difference in the data upon which the arguments are based and the comparative standards used. For example, in the use of data, some used hydrological data of very poor precision compiled before liberation because of insufficient information, some used data compiled by hydrological control stations and the amount of information was too scarce. In the use of comparative standards, some arguments used the total annual amount of sand transported by the river while some arguments used the amount of sand in one cubic meter of water (content of sand). We believe that if the data used and the method of comparison are unified, then such divergent arguments are easy to reconcile.

For actual conditions in the Chang Jiang River Valley, we must appropriately estimate the production of sand by forests when estimating changes in the amount of mud and sand. On the one hand we must realize that the effect of destruction of forests upon the mainstream and the tributaries is obvious. Changes in the average amount of sand transported and the content of sand in such tributaries as the Min Jiang and Jialing Jiang which we discussed above can explain this point. In addition, the relationship between the actually measured amounts of flow and the content of sand at some hydrological stations on the Min Jiang shows that with the same amount of flow, the content of sand in 1959 can be several dozen times greater than that measured from 1955 to 1957. This shows that soil erosion had greatly worsened in 1959 after the



devastating destruction of forests in 1958 and 1959. Therefore, the uncontrolled felling of forests which still exist up to now in some regions must be strictly prohibited. But, it can also be seen from the above discussion that the effect of such human activity as the destruction of forests along the tributaries on the amount of mud and sand is limited to the tributaries themselves, and the effect upon the mainstream is not visible. The main reasons are the following:

(1) The mud and sand in the tributaries are coarse, the distance over which they can be carried is short, most deposit or silt along the way. Therefore, the ratio of input and output of mud and sand in each of the tributaries of the Chang Jiang River Valley (the ratio between the amount of sand carried out by the river and the amount of sand entering the river from the river valley) is smaller than 1:1. The mud and sand from erosion in tributaries can all enter the mainstream of the Huang He.

(2) The amount of mud and sand in the tributaries is smaller than that in the mainstream. The increase in the amount of mud and sand as a percentage of the amount of mud and sand in the mainstream is even smaller, therefore it is not easily detected. For example, the average amount of sand transported during the 1960s at the Wusheng Station on the Jialing Jiang has increased 54 percent since 1958 but constitutes only 6 percent of the average amount of sand transported in the mainstream at Yichang Station during the same period.

(3) The mainstream and the tributaries will not simultaneously surge, the mainstream and the tributaries can mutually dilute the mud and sand in them.

(4) The function of reservoirs in blocking sand. We made some estimates from data of the annual average amount of sand blocked by some large, medium and small reservoirs in the Chang Jiang River Valley, the United States and Japan. The results show that because of the effect of blocking sand by the various types of reservoirs at the upper reaches of the Chang Jiang, the amount of mud and sand prevented from entering the mainstream of the Chang Jiang constituted about 6 percent of the average amount of sand transported during the 1970s at Yichang Station.

Finally, we should explain that we believe there is no danger that the Chang Jiang will become another Huang He based on the conditions of the entire river valley of the Chang Jiang. This does not mean that problems of mud and sand do not exist in individual tributaries or local regions. Conversely, local problems of mud and sand such as silting in river channels and reservoirs, blocking of lakes, inland seas and navigational channels not only exist, they have worsened in recent years as a result of such human activity as uncontrolled felling of forests and they have affected safety in flood prevention, the useful life of hydraulic projects, transportation and shipping. Therefore, actively doing the work well in retaining water and soil in the Chang Jiang River Valley is extremely important.

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CSO: 5000/4057

## PROTECTION AND MANAGEMENT OF THE GUANTING RIVER SYSTEM

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese, No 4, 1982, pp 8-10

[Article by Liu Yansheng [0491 3601 3932]: "Managing Environmental Protection of the Water Sources of the Guanting River System"]

[Text] The work of protecting the water sources of the Guanting river system began in 1972, at that time, it was discovered that the reservoir was polluted. After approval by the State Council, a leadership group to protect the water sources was established, a great deal of work was done to organize and mobilize strength from various sectors. Within a few years, pollution was controlled, the water quality improved and various water quality indicators basically satisfied the criteria established by the state. The management work was an important part of protecting the water sources of the Guanting river system. They mainly involved the following:

### I. Managing the Sources of Pollution

Beginning in 1972, surveys of the sources of industrial pollution were conducted and plans made to control them. Seventy-seven construction projects were carried out to tackle major sources of pollution. The amount of industrial waste water and pollutants was reduced, thereby reducing the major pollutants in rivers and reservoirs. On this basis, each of the major sources of industrial pollution also established a management system to prevent pollution. Some factories established specific regulations in each shop and each work section to strengthen the management of waste water, including strict operation, efforts to stop accidental discharge of pollutants, efforts to strengthen monitoring and inspection of polluted water, efforts to separate the flow of polluted and clean water, efforts to reduce the consumption of water in production, efforts to keep the treatment facility operating normally and to maintain a better treatment results, and control the release of waste water.

The water source protection department strictly monitored and inspected the polluting sources. In 1980, local environmental protection departments along the Guanting river system began to implement a fee system for polluting the water, this is an effective method to control the polluting sources today.

According to the environmental protection law and state regulations, the environmental impact of newly built enterprises and expanding enterprises must first be evaluated. There must be treatment facilities for waste water, waste gas and waste slag; furthermore, the design, construction and operation must be done simultaneously. The environmental protection agencies at each level in charge of protecting the water sources of the Guanting river system insisted on the "three simultaneous efforts," evaluation and management, thus they guaranteed that new sources of pollution and damage would not be created.

The management of polluting sources mentioned above is the management work established during the initial stage of protecting the water sources of the Guanting river system. Because such management was established simply on the one factor of the polluting source, it generally did not involve analysis of quantitative relations when considering such factors as the actual function and effect of the polluting sources upon the body of water and the ability of nature to purify the pollutants. Therefore, simple implementation of such management is not closely related to the improvement of water quality of the body of water. Such a situation may occur in which a certain polluting source is relatively far away from the body of water and the pollutants released into the natural environment are easily purified by the natural environment, the actual effect upon the water quality of the body of water is not necessarily very great, but because of a lack of quantitative research, relying only on the soft-handed method of inference in management frequently will require the investment of too many managerial forces, and thus manpower, materials and funds are scattered and a definite degree of waste is created.

## II. Water Quality Management of the River Channel

Water quality management of the river channel is a measure to consider the self-purifying ability of the river channel and the possible load of pollutants the river is capable of bearing on the basis of the present water quality level, to improve the quality of the body of water and to maintain a certain water quality level.

To improve the quality of the body of water, we must first find the key to improving the quality by analyzing the water quality of the river; at the same time, we must investigate and calculate the river's natural purification of these pollutants and the possible load of the river to achieve a certain water quality. We must utilize mathematical models to calculate and derive the requirements for releasing pollutants by the polluting source, i.e., concrete regional standards for the release of pollutants. In actual work, several different plans may be proposed. These must be analyzed according to their economic gains and finally the plan that is feasible and that is more satisfactory should be selected. This work is called water quality planning. According to water quality plans, each polluting source should treat and control the release of the pollutants. This means that the polluting sources are to be managed. We call this water quality management of the river channel or water quality planning and management of the river channel.

Because the planning and management of water quality begins with the goal of improving the water quality of the river channel, use scientific calculations and manage the polluting sources with a goal and with an aim, therefore, theoretically, the connection between management of the polluting source and improvement of water quality of the river channel is close. The forces can be more centrally utilized, and the limited manpower, materials and finances can develop their maximum gain in protecting the water sources. It is more scientific than the management based on the simple viewpoint of controlling the polluting source. The Guanting river system began conducting test point type research in water quality planning and management in the Yanghe-Xuanhua section in 1980 on the basis of the original efforts to manage the polluting sources. Planning has been completed and implementation of water quality management is being organized.

### III. Zonal Management in Protecting Water Sources

The environmental and socio-economic conditions of different river sections of a river system are different. Thus the goal and measures to protect water sources should not be the same. Therefore, we must mark out several different zones for protecting water resources according to the location of different river sections and the different environmental and socio-economic conditions. The key content of the work of protecting the water sources in each zone must be clear. Various types of management measures to protect the water source should be proposed and they should be aimed at the different concrete situations in each zone. The Guanting river system can be divided into three zones to protect the water source: Guanting Reservoir and its surrounding areas (including Shacheng in Hebei and Yanqing in Beijing) are first level protection zones. Relatively large polluting sources are not allowed within this zone based mainly on the water quality requirements of the reservoir. For sections of the large and small rivers that flow directly into the reservoir, a higher water quality standard must be maintained. Also, a safety coefficient must be established according to the reservoir's ability to purify itself naturally. Only in this way can we guarantee that the reservoir is not polluted. The major towns and cities at the upper reaches of the Guanting Reservoir and regions with a concentrated distribution of polluting sources are zoned as the second level protection zone. This zone mainly includes such towns and cities as Xuanhua, Xiahuayuan, Zhangjiakou and Datong along the river. This zone serves mainly to control the release of pollutants to gradually improve the water quality of each of the river sections of the upper reaches. The third level zone is the broad area outside the towns and cities of the upper reaches. This zone mainly serves to control pollution by agricultural chemicals and natural polluting sources. Because the Guanting river system is located in a region of hilly loess mountain land, this zone also serves the function of preserving water sources, retaining soil and water and purifying a part of the water sources.

### IV. Comprehensive Management of the Environment of the River Valley

The body of water of a river system is not isolated and closed. Its water quality is closely related to the natural environment of the river valley and

human activity. For example, in the relationship between water quality and quantity, the distribution and allocation of quantities of water involve the natural environment and the allocation of water for human use. To develop production and to develop the resources in the river valley where a river system is located, irrational arrangement of production and irrational development of resources will not only cause destruction of the natural environment, they will also cause pollution of the water source. Therefore, we must combine the protection of the entire natural environment in efforts to protect the water source. In addition, utilizing the laws of nature between the water source and other environmental conditions, treating the balance between the water source and the natural environment well, fully utilizing the capabilities of the natural environment to purify the pollutants in the water source are all beneficial to protecting the water source. We should fully utilize these in our work to protect and manage the water source. It can be seen that as the work of protecting the water source deepens, we must implement comprehensive management of the natural environment of the whole river valley and socio-economic activities before we can guarantee the water quality of the water source and before the water source can be fully and rationally utilized. To implement environmental management of the river valley, we must first comprehensively evaluate the natural resources and the environment of the entire river valley and combine the evaluation with the economic development of the river valley to produce an environmental plan that will protect the environment, fully utilize resources and develop the economy. Then, we can implement measures corresponding to the plan to carry out comprehensive management of the environment (including water sources). This work is relatively complex and it cannot be completed alone by water source protection departments. At present, such comprehensive management has not been implemented in the Guanting river system and valley, but as the work to protect the water source continues to deepen, and as the national economy continues to develop, this type of management will be a necessity. We hope that concerned leading departments can include this aspect of work in the daily agenda as soon as possible.

In addition, in management work to protect water sources, we should also gradually introduce such means of modern science and technology as automated monitoring and management methods to improve the standard of management so that the work of protecting the water source can join the ranks of modernization as early as possible.

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CSO: 5000/4057

## STUDIES FOCUS ON REDUCING DISCHARGE OF POLLUTANTS INTO ESTUARIES

Beijing HUANJING KEXUE [JOURNAL OF ENVIRONMENTAL SCIENCE] in Chinese No 3, 30  
Jun 82 pp 67-70

[Article by Wu Yudian [0702 3842 4551] of Xiamen University]

[Excerpts] Investigation on the Ways of Discharge

On the basis of the chemical characteristic of the estuarial and coastal waters of China, the following two forms of waste discharge are proposed for further investigation and study:

(1) The Chang Jiang and the Huang He rivers of China are world famous turbid water systems, the turbidity of the waters entering the sea from these rivers is very high. On the basis of this characteristic, the method of discharging separately sewage and industrial wastewater may be adopted. Sewage may be discharged first to allow the humus content of the sewage to react fully with the mixture of granular materials in suspension in the water to produce a layer of organic film covering the surface of the solids before the industrial wastewater is discharged. The heavy metal contents of the industrial wastewater will promote the formation of the organic film and the existence of this membrane will further accelerate the process of organic complexing reaction of metals. This method is favorable for the heavy metals to be fixed by the clay minerals and to sink into the bottom of the sea. When  $FA/HA \ll 1$  in sewage, the harmful metals will flocculate and settle in areas near the estuary ( $Cl\% \approx 10$ ) at the same time, the hydration rate of the sediments is low and the physical property is relatively good. When  $FA/HA \gg 1$ , the harmful metals precipitate in the distant ocean ( $Cl\% > 15$ ) where the hydration rate of precipitants is high, the floating capacity is great; therefore, they are moved to farther distances.

If, on the contrary, industrial wastewater is discharged first before discharging sewage, when the ratio of  $FA/HA$  in the wastewater is relatively high, it will be possible for the harmful metals fixed on the surface of the suspended granular materials to be dissolved and detached once again to enter the body of the water for the second time to increase its load of metal compounds.

(2) Controlling the  $FA/HA \gg 1$  in sewage in the discharge by mixing the sewage and the industrial wastewater according to the quantitative ratio of

chemistry so that the FA in the sewage and the heavy metals produce soluble organic metal complexes having a high and stable rate of transfer and being harmless to living things before discharging the mixture into the estuary during ebb tide to cause it to flow with the tide into the ocean is the other method [proposed in the paper.] Or the mixture, under the action of high salinity, will flocculate and precipitate into the bottom of the sea. When the FA/HA  $\ll$  1 in the sewage, the mixture of sewage of daily living and industrial wastewater may be discharged in the estuarial sea where the turbidity is high and the organic metal complexes of high molecular weight will quickly adhere to clay minerals to precipitate together and be buried in the bottom of the sea.

In a word, the form of discharge should be determined according to the environmental conditions, the degree of wastewater treatment, and the specific characteristics of the industrial wastewater for the purpose of preventing changes of the benthic environmental condition (such as the state of oxidation reduction, the growth and propagation of microorganisms and benthonic living things, the chemical condition of the benthic water, etc) to induce the possibility of re-suspension of the precipitants and the heavy metal contents of the precipitants to be re-released to create secondary pollution of the water body. Of the two forms of discharge, the second form should be better.

The above suggestions will be further experimented in the following two designs:

(1) A laboratory model of the estuarial water body is to be established to determine the heavy metal transfer effect under the condition of coexistence of clay minerals, FA, HA. Experiments have proved that the FA in the water body is basically not adhered to the clay minerals while the HA is obviously concentrated on the surface of the clay minerals. Results of orthogonal design experiments indicate that the existence of HA improves the ability of clay minerals to fix heavy metals. Thus, the existence of FA is favorable for the diffusion and transfer of heavy metals in the water body; the existence of HA accelerates the precipitation of heavy metals toward the bottom of the sea.

(2) At the sewage treatment plant of a certain city, the sewage treated with mud of various degrees of activity is mixed with turbid water of the river in different ratios before proceeding with model experiments of the hypotheses suggested in this paper. This portion of the work is still in the process of being prepared.

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CSO: 5000/4057



## WATER SHORTAGE SPURS EFFORTS TO REDUCE INDUSTRIAL POLLUTION

Guangzhou HUANJING [ENVIRONMENT] in Chinese, No 6, Jun 82, p 3

[Article by Jin Jianming [6855 7003 2494]: "Water Resources Facing a Crisis"]

[Excerpt] The world's water resources are facing a crisis and China is no exception. According to population averages, China is not rich in water resources. With the uneven distribution of water between regions, the uneven distribution of monthly rainfall and runoff, the large variation between years, the drastic increase in the use of water in production and in life, the conflicts for the use of water are worsening.

To solve China's problems in water resources, the first is to change the out-dated concept that water "is inexhaustible," to establish an understanding of water from the ecological viewpoint and the economic viewpoint, and to truly regard water as a "precious resource." From the higher authorities to the lower echelons, every profession must propagandize the important meaning of protecting and treasuring water resources, and everyone must conserve and rationally use water.

Developing and conserving sources are important ways to solve the problem of water resources. Developing sources means rationally and fully utilizing water resources of the locality. Last year, to assure the supply of water for Beijing, the supply of water by the Miyun Reservoir to Tianjin was reduced and the water of the Huang He was brought in from Henan and Shandong to solve the shortage of water in Tianjin. This is a good example. Conserving sources mainly involves reducing the amount of water used by industry and agriculture. One source of water should serve many purposes, the rate of recycled use of currently available water resources, the rate of re-utilization and the rate of using returned water should be improved. The wasting of water in China is shocking. Foreign nations use only 20 tons of water to produce one ton of paper, China uses 200 to 700 tons. Foreign nations use 0.3 to 1.2 tons of water to refine one ton of oil, China uses 2 to 32 tons. It is obvious that the potential to conserve sources via technical improvements and by raising the level of management is very great. To achieve the purpose of conserving water, Shanghai has implemented economic incentives to encourage factories to comply. Units that use more than the specified amount

of water must pay two to five times the fee. Beijing has also drawn up six measures to utilize and protect water resources.

Preventing pollution is an important aspect in solving the problems of water resources. Now, in many regions of China, the problem is not that there is no water, the problem is that the water sources are polluted and available water cannot be used. Cities and towns near certain rivers and lakes frequently cannot use the water for drinking because the rivers and lakes are polluted. In recent years, some areas by emphasizing environmental management work, extending regional comprehensive management and implementing measures to collect fees for releasing pollutants, have realized visible results in stimulating the treatment of various kinds of industrial waste water and have eased the shortage of water at the localities to a great extent.

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CSO: 5000/4057

## RADIOACTIVITY IN SPRING WATER FORCES OFFICIALS TO ISSUE HEALTH WARNING

Guangzhou HUANJING [ENVIRONMENT] in Chinese, No 6, Jun 82, p 6

[Article by Zhong Bingnan [6945 3521 0589] and Chen Xiuxiong [7115 4423 7160] of the Guangdong Provincial Testing and Analysis Research Institute: "Beware of Radioactivity in Mineral Water"]

[Text] A certain region has two small mountain villages, an east and a west village, although both villages have green mountains and clear water, their fates have been very different. The people in the east village drink the mountain spring water on the east side, the population is flourishing. People in the west village drink the mountain spring water on the west side but there are few offspring. Therefore, people say that "the land of the east village is good; the land of the west village is evil." "Drinking the water in the east village gives people long life, drinking the water in the west village leaves people with no offspring." Why? The state geological team sampled and analyzed the mountain spring water of the east and west village. They discovered a high content of such radioactive elements as uranium, radium and radon in the water of the west village. Later, they followed the clues and discovered a large uranium deposit in the area of the west village. The mountain spring water of the west village flowed from the crevasses of this rich mineral layer. Sterility, miscarriage and dead fetuses were caused by chronic radiation sickness, no wonder the west village almost became extinct.

We must be aware that mineral spring water containing radioactive substances frequently cannot be detected by sight and taste. Because this type of water is like clean mountain spring water, it is very clear, it does not have a strange taste, and its content of radioactivity can be measured only by instruments. Currently, foreign nations and China are paying a lot of attention to pollution of mineral spring water for drinking by radioactive substances. According to investigation, the content of radioactivity in mineral spring water in China and abroad is slightly high. In general, the concentration is between  $10^{-11}$  and  $10^{-8}$  curie/liter, 40,000 times higher than the healthy standard of  $1 \times 10^{-12}$  curie/liter established by the European Health Organization. If we drink such mineral spring water, how can it not affect our health?! Therefore, when drinking mineral spring water, we must ask concerned departments to conduct strict analysis and measurements so that we will know when to stop drinking such water.

Why does drinking spring water with a high content of radioactive elements affect our health? Because after radioactive elements enter the human body, they will emit  $\alpha$ ,  $\beta$ ,  $\gamma$  rays and irradiate the internal organs of the human body. In particular, the ionization of  $\alpha$  particles is very strong. It can directly destroy cells and cause a radiation disease that can affect the ability of the human body to produce red blood cells. The main symptoms of the patient are physical weakness, fatigue, loss of hair and a drop in the count of white blood cells.

To protect people's physical health, the fundamental measure to prevent internal irradiation by radioactivity is to lessen the amount of radioactive substances from entering the body as much as possible. In particular, residents in the granite regions of Nanling must be very careful when drinking local well water and spring water. The water must be strictly tested, wells with water that is seriously polluted must be firmly closed. In addition, we can take corresponding measures according to the characteristics of radioactivity to reduce the content of radon in the water; because radon is a gas, mixing the water for 15 minutes can allow half of the radon to escape. After the water has been boiled, most of the radon gas will escape. Because the half life of radon is 3.825 days, and the half life of the last 3 or 4 radon particles is also strong, another way is to extend the time of keeping the water so that the radon gas will attenuate. If the water is kept for one day, radioactivity of such elements as radon will lessen nearly one half. There is another important aspect, we must strictly prohibit factories and mines that produce radioactive substances to release at will radioactive waste liquids, waste slag and waste gases that surpass the health standards.

Yet, all types of water in nature contain a small amount of radioactive substance, therefore, absolutely preventing radioactivity from entering the human body is not possible. Actually, the human body itself also contains radioactive substances, there is no need for fear. Radioactivity will destroy the cells in the human body, but the human body has a definite ability to repair damage due to small amounts of radiation. Man has evolved over several million years, and he has gradually adapted to a low level of radioactivity and has achieved a relative balance. Only when this balance in radiation has been destroyed, when quantitative change has become qualitative change, will human health be affected. To avoid unfortunate accidents, it is necessary to learn about radioactive substances.

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CSO: 5000/4057

## SHANGHAI HUANGPU RIVER POLLUTION PROJECT TO BEGIN

OW041328 Beijing XINHUA in English 1226 GMT 4 Sep 82

[Text] Shanghai, 4 September (XINHUA)--A 3,000 million-yuan project will soon be implemented here to treat pollution in the Huangpu River, the main source of water for drinking, industrial and agricultural use in this biggest urban center of China. ✓

Shanghai depends on the Huangpu River, a tributary of the Yangtze, for drinking water for its six million people in the city proper, and the river also supplies the needs of 8,000 factories and irrigates more than 353,000 hectares of farmland on the outskirts of the city.

As the first step, according to a plan worked out at a meeting jointly held by the State Economic Commission and the Ministry of Urban and Rural Construction and Environmental Protection, efforts will be concentrated on improving the quality of drinking water from now until 1985 by building pipelines to divert water from the upper section of the Huangpu River to the city's waterworks. That section is much cleaner, according to municipal authorities.

Until now, drinking water has had to be obtained mainly from the lower section of the river, where more than 100 large industrial enterprises are also located. At present, authorities said, approximately five million tons of industrial sewage are discharged into the river every day.

Beginning from 1986, work will be concentrated on treating pollution in the lower section of the 82.5-kilometer Huangpu River running through the city, until the water is clean enough to sustain fish. The entire process is scheduled for completion by the end of the century.

The plan, which was worked out at the meeting of experts from 29 to 31 August, also calls for improving the quality of water in some tributaries of the Huangpu River.

The meeting urged factories along the Huangpu River to help in the project by redoubling their efforts to treat their own sewage, waste gases and materials.

CSO: 5000/4077

## MANY REGIONS LACK DATA TO SUPPORT EFFECTIVE ENVIRONMENTAL IMPACT STUDIES

Beijing RENMIN RIBAO in Chinese 29 Jul 82 p 3

[Article by Chen Jingsheng (7115 7234 3932) and Wang Dengsan (3769 4098 0005):  
"Seriously Implement the System of Evaluation of Environmental Impact"]

[Text] Evaluation of environmental impact refers to carrying out thorough research and forecasts on the basis of the principles of ecology on what adverse effects there might be on the environment in developing any natural resource or in constructing any large project before carrying them out in order to prevent destruction of natural resources and deterioration of the quality of the environment. Through evaluation, we can select the most suitable method of development or construction and not permit projects that would have unfavorable effects on environmental protection measures to be carried out. Some countries have codified this working method in the form of law so that it has become a regulation that must be observed. This is a system of evaluation of environmental impact.

This system has recently been incorporated into the environmental protection law of China. The "environmental protection management method for capital construction projects" that has been promulgated in this country includes concrete stipulations in regard to the scope of evaluation of environmental impact and to the content of environmental impact reports. However, in actual work, there are some regions in which the system has not been implemented with sufficient seriousness. One major cause of this is that the work of evaluation of environmental impact has grown at a generally slow rate which is not in conformance with the rate at which the items initiated in the nation's economic plans have been completed. In order to change this situation, we propose the following:

1. Intensification of basic research work relevant to evaluation of environmental impact.

At present, there are many regions in which there is a lack of detailed data on environmental background conditions, there is little basic research relating to evaluation of environmental impact, the specialized technical corps for evaluation of environmental impact are very weak and organizational structure are inadequate. After an evaluation assignment has been made, a

group must often have to be put together on a temporary basis and start from scratch, this inevitably affects the speed and quality of evaluation. Under these conditions, it is sometimes necessary to spend two or three years to complete an environmental impact evaluation assignment in a fairly satisfactory way. Because too much time is spent, units responsible for construction projects often cannot wait, as a result they are not willing to observe the procedures and measures for the construction project of the environmental impact evaluation. In order to change this situation, we must devote a great effort to intensifying basic research work relevant to environmental impact evaluation. In this matter, there are a number of experiences of other countries that we can use for reference. For example, many countries have conducted basic individual environmental impact research in different categories including research on typical fuels, raw materials, typical technological processes and typical engineering projects (such as irrigation works and road and harbor construction) and typical land uses (such as use for grazing land, forest development and urban-rural planning). As a result, there has been an accumulation in the relevant literature of various types of typical technical data and economic data that environmental impact evaluation workers can use. Thus, when an environmental impact evaluation is to be undertaken, the basic work does not have to be started from scratch, the time required for environmental impact evaluation can be greatly shortened.

2. We should revise the procedures for examination and approval of construction projects.

In determining a construction project at present, a planning and job report is first submitted to higher authorities by the concerned enterprise or institution and the environmental impact evaluation can only be made after it has been approved by the higher level planning department. As a result, environmental impact evaluation work often cannot be done adequately and is sometimes done only as a formality because of the press for time. On the basis of experiences both in this country and other countries, we propose that a clear stipulation be made to the effect that each unit submit an environmental impact report to the higher authorities at the same time that the construction project planning and job report is submitted as a reference for determining whether or not to approve the project. Therefore, an environmental impact report should be made first when plans are being drawn up to develop and utilize natural resources or when preparations are being made for a major project. The higher level department should formally make known its investment only after having passed the environmental impact report. It is only in this way that the project construction procedures of the environmental impact report can effectively play its part in protecting the environment and in protecting our land resources.

3. We propose that the Party and the state make environmental impact evaluations in regard to policies when major political and economic policies that could have marked effects on the environment are being formulated. In this way, it can be assured that great political and economic benefits will be obtained, at the same time, it will be possible to predict what detrimental effects will be produced on the environment in certain regions and under certain conditions so that appropriate countermeasures can be formulated as soon as possible.

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CSO: 5000/4057

RELATIONSHIP BETWEEN ENVIRONMENTAL PROTECTION, ECONOMIC RESPONSIBILITY SYSTEM  
DISCUSSED

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese No 6, Jun 82 pp 6-8

[Article by Zhao Zongliu [6392 4844 3177] and Zhuang Ronghua [8369 2837 5478]:  
"How To Implement an Economic Responsibility System in Environmental Protection"]

[Text] I. The Method of Implementing an Economic Responsibility System in  
Environmental Protection

(1) Principles. An economic responsibility system in environmental protection is a component of the economic responsibility system. Therefore, it must follow the basic principles of the economic responsibility system. The economic responsibility system must correctly handle the relationship among the state, the enterprises and the workers, generally, it should follow four fundamental principles: First, it must guarantee the overall completion of state plans, it must be beneficial to improving economic gains and environmental results, it cannot guarantee only profit. Second, the cooperative relationship of all departments within the enterprise must be included in the economic responsibility at each level and must be connected with economic benefits to guarantee that the ultimate economic effectiveness of the enterprise is increased. Third, the relationship of the benefits of the state, the enterprise and the individual must be correctly handled. Enterprises can retain more and the individual can receive more only under the prerequisite that the state receive more revenue. Fourth, the economic responsibility system must be implemented down to the individual, arouse everyone's enthusiasm and promote the continued improvement of administration and management. The more the economic responsibility system in environmental protection can fully realize the principles described above, the more effective role it can play.

(2) Substance. The content of the economic responsibility system includes two parts. One is the requirements of state plans, the second is the various requirements of administration and management of the enterprises. The former is being responsible to the state and to contract work offered by the state, it is the basic content. The latter is to better complete state plans and to increase economic gain, it is work assigned within the enterprise to the shops and scientific offices. The Capital Steel Mill divided economic responsibility into three parts: The first was to guarantee profits, guarantee increased benefits, guarantee a fixed number of workers. The second was to guarantee production, quality, variety, contracts, cost, operating capital, physical and equipment safety, environmental protection, test manufacturing of new products,



scientific research tasks, rationalization of productive organization and rationalization of administration and management. The third was to guarantee cooperation in work, mainly the first work procedure guaranteeing the work of the next procedure, the departments and offices guaranteeing the plant and the mines, mutual guarantees among the plants, mines departments and offices.

Now, enterprises that have launched the economic responsibility system do not follow the same methods in each locality. Capital Steel Mill included environmental protection as one of the guaranteed tasks, its indices for evaluation constituted 5 to 10 percent of those of the plants and mines. Some regional enterprises have established rules that if the indices for evaluation of environmental protection cannot be completed, over 20 percent of the total monthly amount of cash rewards for the shop will be withheld. Some have ruled that the rewards be deducted completely and no rewards be paid; some deducted 1 to 10 percent of the rewards for profits of shops kept by the shop itself. Some established the percentage points taken up by environmental protection according to the amount of pollution by the shop. Generally the percentage for environmental protection is 10 to 30 percentage points and some reach 40 points. Which form is the best is determined by the situation of the enterprise; the percentage of the indices for evaluating environmental protection is determined by the amount of environmental pollution by the enterprise and the load of work.

(3) Steps. The first step is to let the enterprise separately assign economic responsibilities of the two different natures described above to the basic level units and the service departments to complete the goals of state plans and the goals of management established by the enterprise itself. Their economic responsibility and their method of evaluation are separately established. The goals to increase benefits and profits serve as a basis for synthesis, at the same time establish conditions for awarding or deducting points separately for the goals to be guaranteed and the requirements for cooperation. Such guarantees bring out economic results and also prevent purely pursuing profits and independent development.

The economic responsibility of the service departments of an enterprise is to guarantee profit goals, professional goals and work requirement, service to the basic levels and the cooperative relationship. For example, the environmental protection department of the Capital Steel Mill has two guarantees, one is to guarantee company profit and the other is to guarantee a work force of 51 persons. There are 64 projects that are guaranteed. Among them, the main one is to guarantee a fund of 4.8 million yuan of the profit from the comprehensive utilization of the "three wastes," to guarantee 43 goals for the release of smoke, dust and sewage of each plant and mine, to guarantee that the six major pollutants in the waste water released at the general release gate of the company meet the goals, to guarantee that the qualified percentage of dust from the chimneys taller than 30 meters used in the production process at the plant surpasses or reaches 74 percent, to guarantee that the rate of retrieval and utilization of solid waste reaches 90 percent, to guarantee that major incidents of pollution are eradicated, to guarantee that new polluting sources are controlled 100 percent to implement "the three simultaneous efforts," to guarantee that funds for environmental protection and treatment are not over-spent, and to guarantee that the plans are economical, rational and effective,

etc. Six cooperative relations must also be guaranteed, mainly by providing necessary information and data on the environment to the factory and the department.

The second step is to let the basic levels and the service departments of the enterprise divide and strengthen the economic responsibility they have, and assign the responsibility to each subordinate level until it is assigned to every worker. For example, the power plant of the Capital Steel Mill divided and strengthened the five goals of the task of guaranteeing environmental protection and assigned them to the four scientific laboratories of the plant (planning department, technical department, dispatching room, motor department) and the six shops (water treatment shop, the first heat treatment shop and the second heat treatment shop, the fuel shop, the electrical tools shops, the mobile repair shop). The technical department implemented six guarantees, i.e., guaranteeing environmental protection projects, guaranteeing that construction costs will not surpass estimates, guaranteeing that environmental protection projects will realize expected results after operation begins, guaranteeing that the rate of recycled sewage of the blast furnace is greater than 94 percent, guaranteeing that the amount of suspended substances in the overflowing water from the  $\phi 30\text{M}$  sedimentation pool does not surpass 100 milligrams/liter, guaranteeing that the concentration of dust released by the electric vacuum of the fifth boiler room is smaller than 200 milligrams/ $\text{M}^3$ , and guaranteeing that the concentration of powder and dust released by the pulverizer in the fourth and fifth boiler rooms is less than 100 milligrams/ $\text{M}^3$ . The water treatment shop has two assigned responsibilities and 16 guarantees. The two assigned responsibilities are to guarantee the realization of the goals on cost and to guarantee a fixed number of workers. The 16 guarantees are to guarantee that the percentage of recycled sewage of the blast furnace is larger than 94 percent, to guarantee the quality of the gas washing water for coal gas in the blast furnace, to guarantee that the retrieval of the amount of gas ash produced and moisture is larger than 17 percent, to guarantee the number of Hongqi machines, the percentage in good condition, the percentage of A grade maintenance of the operational goals...etc.

The economic responsibility of the shop and the scientific offices are also divided and implemented down to every worker to become a system of individual economic responsibility. A few of the guarantees assigned to the individual are indices expressed in monetary units while most are quota requirements for operation and work requirements. They all directly or indirectly reflect comprehensive economic gain and environmental results.

Whether the indicators for evaluation and the quotas are advanced and rational affects the major problem of whether the state can receive more revenue, whether enterprises can retain more, whether workers can receive more, whether the active factors of the broad number of workers can be mobilized. If the goals are too lofty and cannot be reached, the masses will not be enthusiastic. If the goals are too low, the tasks will be easily completed, cash rewards will be easily obtained and the rewards will have no meaning. Therefore, when determining the goals of environmental pollution, we must start out from the actual situation of the plant and determine the goals according to the advanced average levels of the past at the plant. The goals can also be higher than the state's criteria for release and they can be lower than the state's criteria

for release. The level of the goals can be adjusted in practice to maintain advanced level goals so that the units and the individuals must exert efforts to realize economic benefits.

After the goals have been determined, we must carry out strict evaluation. Without strict evaluation, then no matter how perfect the economic responsibility system is, it would be only a sheet of blank paper. We must evaluate every job strictly according to the economic responsibility of the guaranteed tasks. The individual cannot receive more income if the tasks cannot meet the goals and if they do not produce more economic revenue for the state. When evaluating environmental protection goals, we must not consider objective factors, we must not be polite, we must insist that everyone is equal in the evaluation of the goals. Rewards and punishment must be clear so that the rewards will truly serve as incentives. When Capital Steel Mill evaluated the amount of suspended substances in the waste water of the end mines of the mineral company and found that it surpassed the standard, the mill did not consider objective factors and it withheld nearly 20,000 yuan in cash rewards.

Evaluation of the individual worker must be strict when evaluating the tasks he guaranteed to perform and the execution of regulations and systems must also be evaluated. Those who violate the rules should not receive cash rewards for that month or their cash rewards for that month should be withheld. Capital Steel Mill strictly acted according to "the three 100 percents." This means systems and regulations must be carried out 100 percent, violators of the system and regulations must be recorded and reported 100 percent, and all cash rewards for that month to the persons involved must be withheld 100 percent. For example, two people of the smoke and dust inspection work section of the monitoring station of the environmental protection department of the company violated the rules and all of their month's cash rewards were withheld. Capital Steel Mill insisted on carrying out the "three 100 percents" and therefore obtained visible economic gain and environmental results.

## II. Environmental Management by Enterprises Must Carry Out Preparatory Work To Implement the Economic Responsibility System Well

The implementation of the economic responsibility system must possess definite conditions. Currently, the state has ruled that the economic responsibility system will first be implemented in some enterprises, this is related to the economic status of these enterprises, it is also related to the fact that they possess a definite managerial level. The management level of China's enterprises is somewhat backward, environmental management was established rather late, many enterprises are still unsound. During the course of implementation of the economic responsibility system we must also strengthen the course of environmental management, but establishment of the economic responsibility system after all requires some basic conditions. Comparing the environmental management at the bureau level and other specializations of the enterprises, environmental management lacks a foundation, and we are still far from having the basic conditions necessary for the establishment of the economic responsibility system. Therefore, preparatory work for environmental protection by enterprises should be done well in time.

First we must have ideological preparation.

The environmental protection departments of enterprises must fully understand the major significance and function of the economic responsibility system. They must have a sufficient understanding that the economic responsibility system in environmental protection is a component of the economic responsibility system of the whole plant. Any idea that deviates from the goals, the content and the steps of the economic responsibility of the whole plant and emphasizes that environmental protection should be an independent system is not practical and will not be successful. Temporary success will not be stable and there will not be any vitality. This means, we must firmly establish the unity between environmental protection and production, the coordinated development of environmental protection and production, and the viewpoint of uniting environmental results and economic gain. Deviating from this viewpoint will make it impossible to include the economic responsibility system in environmental protection in the economic responsibility system of the whole plant, and to root environmental protection in the work shifts.

Second, we must establish the responsibility of division of labor in environmental protection.

The prerequisite of an economic responsibility system is to clarify responsibilities. Without establishing responsibilities, duties, authority and benefits will be empty talk, and it will not be possible to establish a responsibility system. Comparing environmental management and other specialized management tasks of enterprises, although some responsibilities have already been clearly stipulated, some enterprises have still not completely implemented them. This is a problem that must be solved in preparing for the implementation of the economic responsibility system.

Who should be in charge of environmental protection in enterprises? In view of the nature of environmental protection work and the practical experience of several years, the plant director should be in charge. In view of the experience of advanced enterprises in implementing the economic responsibility system, the plant director must also be in charge. The state has already stipulated in work regulations for plant directors that environmental protection of an enterprise should be their responsibility. Now the question of implementation.

Large and medium sized enterprises should set up environmental protection agencies, this has already been stipulated by state laws. Environmental protection agencies should be comprehensive agencies, they carry out comprehensive management for the environmental protection profession on the basis of division of labor by related service departments. All of the departments of planning, production, capital construction, finance, energy, science and technology, and equipment safety of an enterprise have environmental protection duties. They should all include environmental protection tasks in the work of their own department. It seems that such a division of responsibility is appropriate, and it is also a condition that must be possessed in the implementation of an economic responsibility system.

Finally, we must establish the foundation of basic tasks.

The economic responsibility system, in environmental protection, must take monitoring of data as the foundation. Without necessary data, the degree of completion of responsibility cannot be evaluated, and the size of economic benefits cannot be determined. The monitored data required by the economic responsibility system are stricter than the data upon which the general efforts to grasp environmental quality and calculate the fees for release of pollutants by the whole plant are based. All data used for evaluation and grading and for evaluating points and evaluating rewards have the basic requirement of being accurate and on time. There must be a unified system for transmitting the monitored content, the method and data.

Economic responsibilities are realized by goals, these goals are evaluating goals, their requirements are strict. The environmental protection goals of the economic responsibility system of the whole company of the Capital Steel Mill include 10 categories:

1. Goals of conserving resources, energy and raw materials consumption: These are mainly to guarantee conservation of resources and energy in production, reduce consumption, reduce the amount of "three wastes" released, to realize unified economic gain and environmental results. For example, evaluating goals to compare energy consumption, the amount in furnace coking and comprehensive coking etc. can be established for a unit ton of steel.
2. Goals to comprehensively utilize the "three wastes": The factory, the shop and the work section should all guarantee the task of retaining funds for comprehensive utilization of the "three wastes." For example, the steel slag plant of Capital Steel Mill guaranteed a profit of 400,000 yuan and produced 160,000 tons of slag. The user unit must guarantee that the funds are used up. The steel mill guaranteed that the amount of funds retained for comprehensive utilization of the "three wastes" by the whole company was not less than 4.8 million yuan.
3. Goals to realize clean factory and shops: According to the actual situation of enterprises, the units and the time to enter the factories and shops to clean them should be established and inspection and evaluation should be done according to schedule.
4. Goals for projects to treat pollution within a time limit: The Capital Steel Mill asked the Miyun Limestone Quarry and the Dashihe Mineral Selection Plant to realize a goal of over 90 percent in treating toxicity in dust and to meet the standards in Beijing City for treatment within a time limit.
5. Goals to control the release of various types of pollutants: The first effort is to control the release of pollutants by the polluting source and the second is the goal to control the release of pollutants when the environmental protection facilities are in the best operating condition.
6. Goals to control the total amount of pollutants of the factories and the shops: For example, the coking plant has four goals to evaluate and control the total release of pollutants at the release point.

7. The goals of the four percentages for environmental protection facilities: These are the controlling goals. They are the percentage of good equipment, percentage of work, percentage of treatment, and the percentage of the efficiency of treatment.

8. Goals for best operation at the work post and work requirements: Certain key posts must exercise strict control of goals for operation and work requirements.

9. The goal for the retrieval and utilization of resources: For example, the 94 percent rate of recovery of water used to wash gases in the blast furnace of the power plant is included as an evaluating goal. At some plants, the water recovery and utilization rate is 100 percent.

10. Rationalization of productive organization in environmental protection and rationalization of business management. Evaluating indices must be established according to the factory, work, economic gain and environmental gain.

The economic responsibility system has not been established for very long, the economic responsibility system in environmental protection is even newer. Although they have shown a vitality at the time of their birth, they are not yet mature and need our continued summarization and improvement so that they will be perfected.

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CSO: 5000/4060

## INCORPORATING ENVIRONMENTAL PROTECTION INTO ECONOMIC RESPONSIBILITY SYSTEM

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese No 5, May 82 pp 2-4

[Article by Zhao Zongliu [6392 4844 3177] and Zhuang Ronghua [8369 2837 5478]:  
"Strengthen Environmental Management by Enterprises in Implementing the Economic Responsibility System"]

[Text] I. Implementation of the Economic Responsibility System Has an Important Significance and Function in the Management of the Environment by Enterprises

### A. Problems encountered in environmental management by enterprises

As environmental management by enterprises develops, problems that need to be studied and solved will emerge continually. The main problems are:

1. One problem is the relationship between environmental protection by enterprises and the development of production and the improvement of economic gain, how can the environment be combined with production.
2. Environmental management by enterprises has many aspects. The problem is how to grasp the key problems to lead environmental management to a higher level.
3. There are problems involving the plans for environmental protection by enterprises, the principles underlying the plans, methods and procedures, how can the plans be implemented and assessed.
4. There are problems involving the technical line in environmental protection by enterprises, the economic, technical and management measures.
5. Data management is the basis of modern management, how to establish data management and an index system for the environment.

Solving these problems will have practical significance and a profound influence on stimulating the development of environmental protection by enterprises and in exploring China's own ways of environmental protection. But how do we study and solve these problems? There have been several different opinions over the past years. Now, in view of some of the enterprises that have implemented the economic responsibility system, as long as we include environmental



protection in the economic responsibility system, we can better stimulate efforts to solve the above problems, and thus enable the level of environmental protection by enterprises to improve by a relatively large extent.

B. We should implement the economic responsibility system so that production and environmental protection will both gain

The economic responsibility system is a new form of management and distribution centered around efforts to improve economic gain under socialist conditions. We should change state plans and tasks into the economic responsibilities of enterprises. We should combine duties, authority and benefits, contract work to each level and implement them as an individual economic responsibility system so that the masses will become the masters of the enterprises, and to reflect the superiority of socialism. The economic responsibility system includes environmental protection. The so-called economic responsibility system in environmental protection is only one part of the economic responsibility system. Separated from the economic responsibility system, the economic responsibility system in environmental protection will lose its basis.

The enterprises that have already implemented the economic responsibility system have more or less included environmental protection, and are developing towards the fusion of production and environmental protection and rooting environmental protection work deeply in the shifts, thereby obtaining preliminary achievements. There are also some enterprises that have included environmental protection in their work by combining it with the rewards system although they have not implemented the economic responsibility system. For example, in the small percentage competitions to develop comprehensive economic indices carried out by some enterprises in Shanxi, environmental protection goals constituted 5 to 15 percent. Enterprises in many regions have levied fees on the release of pollution in the workshops. A number of enterprises in Hunan Province have registered some success by having the parties assigned the tasks and responsibilities of environmental protection, carry out the work according to the agreed-upon contracts.

The Capital Iron and Steel Company is an advanced enterprise that has implemented the economic responsibility system, it has been praised by leading comrades of the State Council. The System Reform Group of the State Council and the Economic Research Center of the State Council have also organized special forces to summarize and popularize the experience of that company. The company has undergone visible changes after implementing the economic responsibility system. In the first half of 1981 before implementing the economic responsibility system, the average monthly profit was 23.34 million yuan, from August to December after implementing the economic responsibility system, it realized a monthly profit of over 30 million yuan for 5 consecutive months, showing an increase of 28 percent over the first half of the year and creating a new level in its history. All three profit rates improved visibly. The profit margin in productive value reached 38.55 percent, the profit margin in capital reached 25.61 percent, and the sales profit reached 33.79 percent, all creating a new level over the past and the best level for the nation's joint steel enterprises. Some major technical and economic indices continued to improve and maintained their advanced levels. In 52 comparable indices, 30 were leaders in the same industry. The four indices for the coefficient of utilization of the blast



furnace, the ratio of feed to coke, the comprehensive coking ratio, and the percentage of finished products from ingots reached advanced international levels. At the same time, environmental benefits were greatly improved. The total amount of waste water released by the company reached the state's standards for release, and the average rate of utilization of recycled water in 1981 reached 85.5 percent. The amount of falling dust measured in 1980 was 130 tons/square kilometer/month. This dropped to 75.37 tons/square kilometers/month, a drop of 40 percent. Noise in the plant was measured at 62 decibels, lower than the state standards. In 1981, the environmental and economic gain rose to 12,095,000 yuan and in 1981, the steel mill was evaluated as a model advanced unit in environmental protection by the Ministry of Metallurgy.

## II. The Important Function of Implementing the Economic Responsibility System in Environmental Management by Enterprises

Analysis of Capital Steel and other enterprises show that the economic responsibility system serves the following four important functions in environmental management by enterprises.

1. It is an important step in realizing scientific management of the environment.

Implementation of the economic responsibility system can greatly improve the level of management and administration of an enterprise. The higher the level of management of the entire enterprise, and the more developed its modern production, the more beneficial it would be to the scientific management of the environment and to the prevention of industrial pollution. We cannot imagine an enterprise that is backward in management and administration creating a beautiful environment.

Environmental management must be scientific. Managing automated production equipment using the methods of the handicraft industry cannot manage production well. What constitutes scientific management of the environment?

First, scientific management is standardized management. Poor organization, doing things bit by bit, lack of coordination and the lack of a definite system do not constitute scientific management. The economic responsibility system requires that environmental management establish a responsibility system, all echelons have their duties, authority, and benefits in environmental protection. These duties, authority and benefits must have a whole set of management methods and systems, a standard management order must be established before it can work.

Second, scientific management is modern management. Modern management not only needs quality, it must also have quantity. In order for the economic responsibility system to link efforts with economic benefits and to provide rewards and punishment, it is necessary to establish modernized quantitative analytical management. Before Capital Steel implemented the economic responsibility system, monitored data were basically used only to reflect the situation. After establishing the economic responsibility system, the nature of monitored data changed, they became the tools for examination and the basis for evaluating achievements, therefore they effectively promoted the development of monitoring

work. The economic responsibility system in environmental protection by the plants and mines subordinate to Capital Steel has 43 guaranteed targets, each month, each target is measured three to five times and its average value is taken as the basis for examination. There are rewards for meeting the targets; rewards are withheld for not meeting the targets, favors are not given and situations are not analyzed, everything is based on data.

Finally, scientific management is highly efficient management. It requires enterprises to input less to produce more and to improve economic benefits. Implementing the economic responsibility system is an important link in improving efficiency in environmental management and the economic gains of the enterprise. The steel slag plant of Capital Steel was 175,000 yuan in the red during the first half of the year before implementing the economic responsibility system, after implementing the economic responsibility system, it only hoped to stop losing money. After implementing the system at each level and assigning responsibility to each individual, workers improved labor efficiency and opened up sales everywhere. By the end of the year, the plant showed a profit of 176,000 yuan during the second half of the year and became the outstanding unit of the company.

## 2. It is an important guarantee to realize environmental protection plans.

Implementation of the economic responsibility system must first complete state plans and guarantee macrocosmic economic benefits so that all major economic activities of the enterprise can be included in state plans and the general goals of production management of the enterprise can be realized under the guidance of the macrocosmic economy. The enterprise and the individual worker can only realize benefits under the prerequisite that the enterprise completes the general targets. The goals of environmental plans and the technical measures and plans to realize these goals are all part of the general objective of the enterprise. They should be assigned and implemented in the same way and must become the economic responsibilities of each level down to every worker.

Why have the environmental protection plans of many enterprises failed in the past? One, there were no people to carry out the plans; two, strict examination and necessary rewards and punishment were lacking; three, necessary measures were lacking. Through the economic responsibility system, these problems can be solved better. Capital Steel assigned the responsibility of adopting certain control techniques and measures needed to the basic levels. This included the responsibility of solving pollution further in the economic responsibility system and effectively guaranteed the realization of environmental protection plans.

## 3. It can stimulate the leadership of enterprises and the workers to actively prevent and control pollution.

Because the economic responsibility system divides the economic management of the whole factory into duties and managerial authority and benefits and uses the completion of the responsibility to evaluate economic benefits, it first establishes the responsibility of the plant manager in environmental protection and environmental protection has become a responsibility of the plant manager in leading the enterprise. In the evaluation and records for rewards at Capital

Steel, the plant manager's responsibility in environmental protection constitutes about 5 percent, the responsibilities of the deputy plant manager in charge of environmental protection constitute 5 to 15 percent, the responsibilities of the assistants to the plant manager (office of engineers), related department chiefs, shop managers constitute 10 to 20 percent.

Many comrades paid attention to mobilizing the masses to carry out environmental protection. But how to make the polluters responsible for environmental protection and how to make everyone engage in and be responsible for environmental protection were questions that were not resolved in the past. In the economic responsibility system, the responsibilities of environmental protection were assigned to the shifts. "Everyone shouldered a heavy responsibility and everyone had a goal," thus the enthusiasm of numerous workers in preventing and controlling pollution through technical improvements and minor alterations and changes and in carrying out management measures such as preventing leakage at the work post during production operations was improved. The vacuuming shift, in order to remove dust from the power boilers at Capital Steel, carried out more than 10 renovations of improving the automatic vibration and dusting system of the vacuum, perfecting the rectifier, installing a cabinet by the vacuum housing in order to realize the "five systems of full responsibility" and "or guarantees" of the economic responsibility system. They worked hard to realize the goals for best operation, best consumption and best environment. Because everyone had a responsibility, among the 582,839 dynamic and stationary sealed points in the pipe network of the Capital Steel Company, the number of leaking points have been reduced by 313. In the overall pipe network, the leakage rate was 0.57 percent at the beginning of 1980. This dropped to 0.055 percent in December 1981, and there was a group of plants and shops that had no leaks at all.

#### 4. It enhances environmental protection work.

The economic responsibility system has strengthened the two fundamental tasks of establishing a responsibility system in environmental protection and data management. In the past, most of the responsibility systems in enterprises were concerned with production, technology and business, the responsibility for environmental protection was not sufficiently clear and definite and it was not implemented. Implementation of the economic responsibility system requires everyone from the plant manager down to every worker to shoulder specific responsibilities in environmental protection, and there must be strict criteria for examination. This is one of the major capital construction tasks in environmental protection. Data compilation is the basis for establishing quotas, examination results and distribution of benefits in the economic responsibility system. Environmental statistics are still weak, and are not suited to implementing the economic responsibility system. We must hasten the collection and management of data. Capital Steel established and perfected 15 kinds of primary data for environmental protection while it implemented the economic responsibility system, making environmental protection data regular, standard and scientific.

The economic responsibility system has not only pushed forward the establishment and development of an index system for environmental pollution, it has also gradually turned the simple pollution control indices into a system of indices of comprehensive economic gains. This is welcomed progress in environmental management.

The economic responsibility system has pushed forward the renovation of specialized management in environmental protection, serving the improvement of economic gain and environmental gain and enabling economic and environmental results to be unified.

The economic responsibility system requires a strong monitoring team and high quality monitoring results, otherwise the assigned and guaranteed goals in environmental protection cannot be examined. At present, monitoring and measurement are weak. Capital Steel fully developed the function of second level monitoring. All plants and mines that had monitoring and testing capabilities were responsible for testing the goals in environmental protection at their own plants. The company's environmental protection office only inspected at random, supervised and inspected actual measurements irregularly and inspected the methods of analysis. The task of examining and testing environmental protection results by units without monitoring and testing means was entirely shouldered by the monitoring and measuring station of the environmental protection office to suit the needs of the economic responsibility system.

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CSO: 5000/4059

## CONSERVATION, EFFICIENCY HELP CUT COST OF REDUCING POLLUTION

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese, No 3, 1982, pp 4-6

[Article by Qu Geping. [2575 2706 1627]: "Prevent and Control Pollution, Build a Protective Civilization"]

[Text] Industry is the major source of environmental pollution in China. People acknowledge the damage due to industrial pollution and they are worried but they blanch at the mention of controlling industrial pollution. Why? Because a lot of money has to be spent, the money, however, is not available, this has hindered the control of industrial pollution for a long time.

Does controlling industrial pollution really require spending a lot of money, is there really no money or is the money insufficient? The experience of Anshan Steel Works and many other factories, mines and enterprises has given an answer to the contrary. Their attitude towards controlling industrial pollution was not to wait passively and ask the higher authorities for money. Their leadership emphasized the problem, insisted on self-reliance, mobilized the masses, and created wealth. As a result of their efforts, different measures to control industrial pollution were implemented. The environment continued to improve while harmful pollutants were changed to beneficial materials and many new products were produced. Many materials and much energy were conserved, and growth in production was stimulated. What are the methods and the basic experience of Anshan Steel Works and the localities in controlling industrial pollution?

First, they developed comprehensive utilization of resources, this involved creating a source of wealth and reducing the flow of pollution. There are two main sources of industrial pollution: one is erosion of materials, the other is waste of energy. There are two positions on this question: one is to develop comprehensive utilization, turn disaster into benefit, and create new wealth. One is to let things run their course, worsening the damage from pollution. Anshan Steel Works followed the first approach. They recovered 140,000 tons of pulverized iron, 2,000 tons of pulverized coke, 220,000 tons of steam, 65,000,000 tons of water, and 450,000 tons of waste steel and iron. They conserved 40,000 tons of coal valued at 29,000,000 yuan by using surplus heat each year in comprehensive utilization,

and the profit reached 14 million yuan. They mainly used this source of funds to prevent and control pollution. This type of "snowballing" to create wealth has broadened the scope of comprehensive utilization, quickened its progress, and created greater demand for pollution control.

Developing comprehensive utilization of industrial pollutants is a positive way to eliminate pollution. Premier Zhou issued many directives regarding this supporting the two statements, "reverse a harmful trend and recycle waste material"; he believed they fully express the dialectic method. There are many ways to comprehensively utilize the "three wastes" in industry. The experience of some factories and mines show that at least the following methods have produced rich results: (1) retrieval and utilization of discharged materials. Some of the substances that have been discharged along with gases or liquids have not changed their original physical and chemical properties, they can be retrieved as industrial raw materials or industrial products. The pulverized iron and pulverized coke recovered by the Anshan Steel Works and the powder and dust recovered by the cement plant belong to this type. (2) Recycling and utilization of water and using one source of water for many purposes. The Shanghai Yangpu Lumber Plant recycled and utilized waste water. The rate of utilization reached 96 percent; this not only eliminated pollution, it also visibly enhanced economic gain. Each year, 240,000 yuan in costs were saved, an additional profit of 330,000 yuan was realized, and in less than 3 months, the investment in construction for recycling and utilizing waste water was recovered. The Shandong Paper Manufacturing Plant used the alkaline waste water discharged by the First Jinan Printing and Dyeing Plant to make pulp. As a result, both plants gained, each year they saved 230,000 yuan. Now, many cities suffer water shortages; conserving water is a positive way to ease the shortage. (3) Utilization of surplus heat. The Capital Steel Works converted boilers from burning coal to burning coal gas from blast furnaces formerly released into the atmosphere. This visibly reduced atmospheric pollution, 40,000 tons of coal were conserved a year, and 2,200,000 yuan in profits were realized. Investment made in the year produced results and the investment was recovered within the year. The plant also utilized the heat released during the tempering process for heating an area covering 480,000 square meters, thus 46 boilers were shut down. In one heating season, 24,000 tons of coal were saved and a gain of 1 million yuan was realized. The amount of substances discharged was reduced considerably and the quality of the atmosphere improved. There is a lot of surplus industrial heat, estimates of the metallurgical sector alone show that each year, the amount of surplus heat that can be used can reach 5 million tons of standard coal. The chemical industry, light industry, building materials industry and power industry, all have a lot of surplus heat that can be used. Fully utilizing surplus heat has an important significance in improving the environment and conserving energy. (4) Comprehensive utilization of the "three wastes." The "three wastes" are harmful if discarded but they become valuable when used. Shandong Zhaoyuan Chemical Plant is a small plant producing phosphate fertilizer; the plant utilized "the three wastes" to produce over 10 new products, investment totalled 720,000 yuan. This not only basically reduced serious pollution and eased the tension with the farmers, it also obtained over 900,000 yuan worth of profit from

comprehensive utilization of the "three wastes." The development of comprehensive utilization did not hinder production but effectively promoted the development of production; it did not reduce revenue but increased revenue. In their own words: "Our plant has grown and thrived by relying on the 'three wastes'." Because of the development of comprehensive utilization, the plant leads similar factories throughout China in product variety, quality, profits and environmental protection. This plant's experience is convincing because it is a small plant jointly operated by the county and commune; the technical strength and material conditions cannot compare with those of large and medium enterprises. The plant was able to change the "three wastes" that were harmful to the environment into wealth because the plant possessed the spirit of being equally responsible in its products and in environmental protection. At the same time, the plant realized that without good environmental protection, it would not be possible to expand reproduction, let alone maintain simple reproduction.

Large and medium sized enterprises have better conditions to achieve what a small plant can achieve, and should be able to do it better.

To promote the comprehensive utilization of the resources of the "three wastes," we must also conscientiously implement the policy of reward and punishment stipulated by the state so that industrial and mining enterprises and workers can truly receive material benefits to push forward the widespread development of comprehensive utilization further.

Second, to strengthen environmental management by the enterprises, we must use management to promote prevention and control. China's industrial pollution, in a large degree, is caused by poor business management. According to the surveys of some regions, poor management is responsible for about 50 percent of the harmful substances released by industry. Even if we calculate this at 30 to 40 percent, the proportion is shocking. Strengthening environmental management by the enterprises is a way to greatly reduce industrial pollution without spending much money. Some enterprises have recognized this point and have done this; they have rapidly reduced serious pollution. Their main methods are: (1) They have a positive and practical plan to prevent and control pollution; this plan is an important part of business growth and technical improvement. With this plan, all the workers have a direction and a goal and this helps to arouse their fighting spirit. For example, the 1981-1985 environmental protection plan established by the Anshan Steel Works established the goals and annual activities and measures for those five years. This is an important factor in their continued progress in environmental protection during recent years. At present, China's industrial enterprises are combining reorganization and readjustment to establish development plans. Each enterprise should be like Anshan Steel Works, taking the prevention and control of pollution and environmental protection as the main points to include in their plans. The enterprises should never repeat the mistake of caring only about production and not caring about the environment. (2) Established environmental protection laws, like established production management laws, are the rules and laws of the factory; all workers must abide by them and carry them out. Now, many factories have established such management regulations and have



established methods of examination, reward and punishment. Some factories have also combined production, environmental protection and the worker's personal benefits in implementing the "economic responsibility system of linking production with remuneration." This has mobilized the enthusiasm of numerous workers in preventing and controlling pollution, and good environmental and economic results have been realized. (3) We must implement a method of controlling the total loss of pollutants. This is a management method established by the Shenyang Chemical Bureau to control industrial pollution and to increase economic benefits. This method shows that harmful substances released by industries can all be traced, their origin and their destination can be found, and they can be analyzed and calculated. According to the analysis of typical technological processes, the amount of materials lost because of poor management has reached as high as 86 percent. This method is based on environmental standards; it combines the technical facilities of the factories and the management level, and it is assigned by the bureau to the factories. Factories assign the goals to the shops, the work sections and the work posts, and establish methods of evaluation and rewards. This method combines the production task with pollution control; it combines the benefits of the state, the enterprises and the individuals, and has visibly reduced consumption and environmental pollution. This method has guaranteed the systematic consistency of production and environmental protection, changed the attitude that the prevention and control of pollution can be managed or left unmanaged. This is a new development in business management and environmental management, and overall implementation of this system has an important meaning in controlling industrial pollution. (4) We should develop activities to clean up the factories. This is an activity widely carried out by the Shandong Chemical Industry Department and the Metallurgical Department within their own professions. Cleaning up the factories means to implement the goals of comprehensive utilization of the "three wastes," to guarantee a percentage of equipment in good condition, to control noise and vibration, to ensure shop sanitation, work post sanitation, appearance of the factory premise, greening of the grounds by shops, groups and individuals, and to combine the goals with production management, the "five stresses and four points of beauty," and rewards and punishment. Practice proves that this activity is beneficial to strengthening overall management of the enterprises, and it promotes prevention and control of pollution. All enterprises that have launched this activity have created drastic changes in the factory environment and the people's spirit. (5) We should reorganize the appearance of the factory and green the grounds on a large scale. This is a measure that does not require spending a lot of money and can change the appearance of the factory area within a short period. Many factories have organized surplus production personnel into greening teams or janitorial teams to perform sanitation work and to plant trees and grass. After a few years, landscaping of factory areas has been realized. Flowers and grass are everywhere, trees provide shade, and the scenery is pleasing. (6) We should establish environmental management agencies. All units that have done a good job in environmental protection have established and perfected a strong and forceful environmental management agency which has become an important part of business management. The agency supervises the thorough implementation of environmental rules and regulations.



The measures cited above to improve management and to promote prevention and control of pollution, first do not need much money; second, they do not require sophisticated technology and equipment. If they are stressed, every factory can carry them out. Can we eliminate pollution caused by poor management within 2 or 3 years? This should not be considered a very lofty goal.

Third, we should combine efforts with technical improvement to prevent and control industrial pollution. Industrial pollution is formed during the production process. The amount of pollutants produced is directly related to the techniques and the equipment used. China's industrial pollution is serious; one major reason is that the techniques are backward, the technology is out-dated, and the equipment is old. To change the backward situation in industrial technology is a fundamental way to strive towards a basic improvement in China's financial and economic situation and it is needed in promoting industrial modernization, controlling the polluting source and improving the environment. The experience of some advanced units shows that all of them have combined efforts tightly with technical improvement and they have realized visible results in preventing and controlling pollution. Their method is: (1) to renovate equipment, use advanced energy conserving equipment to replace old and out-dated equipment, especially to replace those old fashioned boilers that consume too much coal; (2) to reform technology, use non-polluting or low-polluting technologies to replace techniques and technologies that have a high consumption and that cause serious pollution, in this regard, the chemical industry, light industry and the metallurgical industry have achieved welcomed achievements; (3) to change raw material supply lines, to use non-toxic or low toxic raw materials to replace toxic and lethal raw materials, which has improved the working conditions and reduced environmental pollution; (4) to use centralized heating and to use large boilers that have a high thermal efficiency to replace small boilers that are scattered and that have a low thermal efficiency, to establish heat supply centers between enterprises or regional centers, which has conserved large amounts of coal and visibly reduced atmospheric pollution; (5) to develop scientific experiments, actively study new techniques, new technologies and new equipment to control pollution, and to guarantee that technical improvements are smoothly carried out.

Combining technical improvements and adopting measures for the comprehensive prevention and control of pollution do not need much money, produce great results and benefits. This requires the technology management departments and all industrial enterprises to pay attention to implementing measures to prevent and control pollution while establishing technical improvement plans so that China's enterprises can truly become clean and civilized modern socialist enterprises as technical improvement progresses.

Fourth, we should combine efforts with industrial readjustment and improve irrational distribution. Some regions in China have serious pollution; irrational distribution is one important reason; particularly the industrial enterprises located in cities, residential areas, regions of water sources and tourist and scenic regions have created even greater pressures upon the environment. What we call the efforts to change the irrational distribution

of industry includes two aspects: One is to move those irrationally situated factories; the second is to readjust the structural distribution of those irrational industries, to change seriously polluting industries or products into non-polluting or low polluting industries or products. In this regard, the chemical industry in Jinan conducted a beneficial test. The closing, shutting down, combining and transferring of some enterprises are an important policy and measure to reorganize and readjust the enterprises. Those enterprises that waste a lot of energy and materials, that seriously pollute, that cannot be corrected over a long period, that have been the target of strong complaints by the people and masses, must all be closed, shutdown, combined, transferred or moved so that the serious and irrational distribution can be turned around through readjustment.

The four aspects above are the main experience of each locality and each profession in controlling industrial pollution. These experiences are valuable because they are fundamental and have common significance in controlling industrial pollution. Of course, not all harmful pollutants can be completely eliminated by these four methods; some necessary purification facilities must be built. If we say that during the past few years, controlling industrial pollution has only been a general campaign without concrete methods, then, now, we have more practical and feasible methods and measures. More importantly, we must find ways to create and accumulate wealth so that we can prevent and control industrial pollution through self-reliance.

9296

CSO: 5000/4057

## CONTROL OF INDUSTRIAL POLLUTION HINGES ON 'THREE WASTES' MANAGEMENT

Beijing ZHONGGUO CAIMAO BAO in Chinese, 21 Aug 82 p 1

[Article: "Preventing and Controlling Industrial Pollution Are the Social Responsibilities of Enterprises, The Conference To Exchange Experience in Preventing and Controlling Pollution by the Nation's Industries Believes That Eliminating the "Three Wastes" in the Production Process Is the Most Positive and Most Effective Way To Prevent and Control Industrial Pollution"]

[Text] The conference to exchange experience in preventing and controlling pollution by the nation's industries ended yesterday. It strongly pointed out that prevention and control of industrial pollution are the social responsibility of the enterprises. When we engage in production and construction, we must emphasize environmental protection, we must closely combine the development of production with environmental protection; we must actively begin prevention and control of pollution, and strive to visibly improve our nation's environment within a short time.

Attending delegates believe our nation's environmental protection must be based on the rational utilization of resources; the control of industrial pollution must grasp this fundamental question. We must start out by strengthening business management, reforming technology, renovating equipment, turning the "three wastes" (waste gas, waste water and waste slag) into resources so that resources and energy sources can be converted into products to the maximum extent and the release of pollutants can be reduced to a large extent. The "three wastes" produced during the course of industrial production must be eliminated as much as possible. This is the most positive and most effective way to prevent and control industrial pollution.

The delegates also believe that in order to effectively prevent and control industrial pollution, each region, every industry and every factory and enterprise should draw up plans to prevent and control pollution, include such plans in production development plans and technical improvement plans, combine them with industrial readjustment and reorganization, improve the distribution of industries to reduce environmental pollution, actively implement all economic and technical policies that will benefit economic

development and environmental protection. We must insist on the policy of self-reliance, mobilize the masses, develop the potential of enterprises, solve one's own pollution problems, exert efforts to channel available funds for environmental protection, and strengthen leadership in the prevention and control of industrial pollution.

This conference, sponsored by the State Economic Commission and the Urban and Suburban Construction and Environmental Protection Ministry, was held in Beijing on 15 August.

9296

CSO: 5000/4057

BEIJING'S COMMUNE-RUN ENTERPRISES FAIL TO CARRY OUT ENVIRONMENTAL PROTECTION WORK

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese, No 4, 1982, pp 6-7

[Article by Guan Li [4619 3810]: "Newly Built Commune and Brigade Enterprises Must Conscientiously Carry Out the 'Three Simultaneous Efforts'"]

[Text] In recent years, Beijing City's commune and brigade enterprises have developed quickly. Since 1974, the number of enterprises, the number of workers, the total production value and profits have respectively averaged an annual growth rate of 4.7; 23,833.2 and 46.8, all far surpassing the rate of development of state-run enterprises during the same period. The development of commune and brigade enterprises has served greatly to increase the income of farmers, promote agricultural production, support large state-run industries, satisfy the people's daily needs and employ surplus agricultural labor. But, a large number of commune and brigade enterprises did not conscientiously implement the state's regulations concerning the "three simultaneous efforts" during construction, thus, many problems have emerged in environmental protection. According to surveys, among the commune and brigade enterprises, in Beijing about 40 percent pollute to varying degrees, and those that have treatment measures constitute less than 10 percent. Of course, the result of treatment of even fewer enterprises have reached the standards. Existing problems in environmental protection are:

1. The environment has been seriously polluted, affecting industrial and agricultural production and the people's health.

A dye factory released a large amount of colored and toxic waste water and dust which damaged nearby farmland, reduced yields and polluted the water source. Compensation for the damage did not solve the problem and finally it was forced to change its product. An electroplating plant released polluted water containing as much as 6,230 milligrams/liter of hexavalent chromium per liter, surpassing the allowable content by more than 10,000 times! Many workers engaged in operations involving mercury, lead, chromium and benzene have been injured and poisoned, at some plants, the percentage of such victims among the total number of workers has reached several dozen percent!

Some enterprises released large amounts of the "three wastes" and polluted nearby farmland even to the point of causing death to livestock. The number of disputes caused by pollution has increased.

## 2. Failure to integrate plants increases pollution.

Now, throughout Beijing there are more than 600 electroplating plants and sites. Among them, commune and brigade enterprises constitute more than 200. The county with the most number of such enterprises has nearly 100. One production brigade even has three! Because of unplanned development, the capabilities of the facilities have far surpassed the need, therefore, many plants do not have sufficient tasks yet some plants still want to build new facilities. Due to unplanned, dispersed construction, the scale of these plants is small, the technology is backward, the consumption of raw materials and energy is frequently several times higher than that of large state-run plants. This not only creates waste, it also pollutes the environment, and it is out of tune with preventive and control measures. Some plants have used all means to "get business" encouraging the development of this incorrect practice.

3. Plants have been built at will without considering the overall plan and distribution of the city. For example, the Sijiqing Commune built a cotton textile plant in the middle of a group of wells at the Third Water Plant. The Yaoqiaoyu Brigade in Miyun County spent more than 100,000 yuan to build a tannery with an annual capacity of 30,000 pig and cow hides at the upper reaches of the Miyun Reservoir. If production begins, up to a hundred tons of various harmful substances and chemical raw materials would be flowing into the reservoir to pollute the body of water. Fortunately, the two plants described above were discovered, concerned departments order them to stop construction and to remove their facilities, but this created a serious economic loss.

There are far more problems in environmental protection created by commune and brigade enterprises; some of their detrimental results will only be exposed several years later.

Why have these problems emerged?

### I. Several misunderstandings.

It is believed that commune and brigade enterprises are small-scale, therefore they will not create massive pollution. Commune and brigade enterprises are mostly small-scale, but because the technology is backward, the facilities are simple, the management level is low, consumption is large, their pollution is not necessarily less than that of large state-run plants and may even be more.

It is believed that commune and brigade enterprises are scattered, therefore they will not cause damage. Actually, this is not so. Because there are many commune and brigade enterprises (more than two times the number of state-run enterprises, in the future, they will rapidly and massively

increase), they have already spread throughout the city, some are built inside zones of protected water resources, some are built in tourist and scenic areas and other important areas. Therefore, their damage cannot be ignored.

Some leaders only consider whether an enterprise earns money or not. Some even proposed the slogan: "All regulations that affect the increase in income of the commune and brigade must be abolished, every unit must be given the green light to increase income for the commune and brigade." These type of slogans are unilateral. We cannot act like capitalists, using every means to earn money. Commune and brigade enterprises must not only account for their own situation, they must also consider the situation of the whole society. They cannot sacrifice the environment of the capital and the health of workers and later generations to "become rich." In addition, protecting the environment well does not always conflict with profit, industries that do not pollute or those that produce little pollution can be developed. Are those plants with several dozen percent of their workers poisoned, those plants that have been forced to cease production and those plants that have been shut down able to earn money? There are many examples of enterprises that have paid close attention to protecting the environment, that have conscientiously carried out the "three simultaneous efforts" and that have become prosperous enterprises.

II. Related regulations promulgated by the state were not strictly implemented.

The "environmental protection law" clearly stipulates: "All enterprises and business units must pay full attention to preventing the pollution and destruction of the environment in site selection, design, construction and production. When carrying out new construction, remodeling and expansion, they must submit an environmental impact report and the report must be reviewed and approved by environmental protection departments and other related departments before designing can begin. Facilities that prevent pollution must be designed, constructed and begin operation simultaneously with the main body of the construction project. This is what is commonly called the "three simultaneous efforts." These regulations are very important in protecting the environment and preventing the production of new pollution; they should be conscientiously implemented by every unit (of course including commune and brigade enterprises). Now, the main reason that pollution in Beijing city has not been controlled and is continuing to develop is that a large number of newly built enterprises especially commune and brigade enterprises have not done things according to the principle of the "three simultaneous efforts," and they have carried out construction without review and approval by environmental protection departments. Some enterprises that have plans that have been reviewed and approved by environmental protection departments frequently do not implement the originally approved plans. Some projects have begun production immediately after completion without first being inspected by environmental protection departments.

III. Each related department "guards its own fortress" and does not communicate with others.

Some industrial departments, foreign trade departments and even certain offices of the Central authority and troop units proceed only from their own tasks and convenience and do not consider environmental protection of the capital, they contact communes and brigades directly to establish polluting enterprises without consent by related environmental protection departments. When the environmental protection departments learn about this, things have already been done. The Yaoqiaoyu Tannery described above was built with the support of the foreign trade department. This situation has occurred even more in the electroplating industry.

We can say at present that the problems that Beijing City's commune and brigade enterprises have in certain aspects of environmental protection are much greater than the problems that state-run enterprises have, and need to be solved more urgently.

How do we solve the problems? I believe the following must be done:

1. Education and propaganda must be carried out in farm villages to educate concerned departments in the "environmental protection law," the importance, the urgency and the knowledge of environmental protection so that the broad numbers of cadres and masses in the farm villages will understand that environmental protection of commune and brigade enterprises all have a special and important meaning to the capital. Each propaganda department must regard the environmental protection of commune and brigade enterprises as day-to-day work.
2. "Measures to manage environmental protection of commune and brigade enterprises in Beijing City" must be established for promulgation and execution by the people's municipal government or the Standing Committee of the People's Congress. The "measures" should clearly stipulate criteria of rewards and punishments.
3. The bureaus of commune and brigade enterprises of each ward and county and communes with many enterprises must appoint special personnel to manage environmental protection. The remaining communes must have people who are concurrently in charge of this work. Their duties and authority must be clearly established. The environmental protection departments of each ward and county must cooperate closely with such departments as the administrative bureaus of enterprises to do the work well together.
4. Deadlines for final treatment of pollution by presently polluting enterprises must be established. Projects in construction must be conscientiously reviewed, construction should be allowed to continue only after it has been reviewed and approved by environmental protection departments.
5. Related departments must establish concrete areas and zones in Beijing as water sources protection zones, scenic and tourist zones, areas of ancient relics and residential areas. Each related department should actively support regions like Miyun which have more economic difficulties and which require more environmental protection and help them establish non-polluting enterprises.



## TECHNICAL IMPROVEMENTS REDUCE POLLUTION AT PETROCHEMICAL PLANTS

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese, No 4, 1982, pp 1-3

[Article by Yan Huan [3501 3883]: "Combining Technical Improvements To Prevent and Control Environmental Pollution"]

[Text] The Yanshan Petrochemical Company is a large joint petrochemical enterprise. Construction of the company began in 1968; now, it has 7 petrochemical production plants with a total of 41 sets of production equipment, 10 of which are complete equipment sets imported from abroad. It also has four auxiliary plants: a power plant, a machinery plant, an instruments plant and a major repair plant. Its established productive capabilities are refining 7 million tons of crude oil each year, synthesizing 370,000 tons of three major synthetic materials, and producing 30,000 tons of basic organic raw material.

In such a joint enterprise that has a production level of the 1950s and 1960s and technology and equipment of the 1970s, besides problems in production technology, the task of preventing and controlling pollution is fairly heavy. During the past 2 years, we gradually explored and found a way to combine technical improvements and environmental protection so that in the course of preventing and controlling pollution, investment would be less, the results would be fast, and both economic and environmental gains could be realized.

1. The company continued to improve its way of thinking, exerted all possible efforts to control damage due to pollution and to produce a definite economic benefits. The main office of the company built three treatment systems for polluted water mainly by secondary biochemical treatment systems for polluted water mainly by secondary biochemical treatment at the beginning period of plant construction. Later, it set up some other measures to prevent and control pollution, but these were mainly to control pollution and their ability to retrieve and use waste to produce a definite economic benefit was not too great. For example, the treatment of tail gas of nitric acid at the Dongfeng Chemical Plant uses the method of catalytic ammonia reduction to eliminate nitrides and oxides in the tail gases. Although this method is a relatively effective treatment and has eliminated pollution, but ammonia is needed in the course of catalytic reaction, therefore, after

the reaction, a part of the surplus ammonia is released along with the tail gases, and economically this was not sufficiently practical. Later, on the basis of continued improvement of thoughts and understanding, we paid attention to unifying environmental and economic gains, and we included projects to prevent and control pollution in the technical improvement plans of the enterprise. Gradually, the plant moved from the treatment of pollution to the comprehensive utilization of resources and energy. Each year, some projects to prevent and control pollution were arranged and included in technical improvement projects. Investment in pollution control projects came from private funds of the enterprise while some funds for projects of comprehensive utilization came from bank loans.

2. In technical improvement, pollution control projects and investment constituted a definite proportion.

We have included some environmental protection measures in technical improvement projects during recent years so that environmental protection projects and investment constituted a definite proportion in technical improvement work. In ordinary situations, the number of projects of environmental protection and investment in environmental protection as a portion of the technical improvement projects were increased year by year whenever possible. The 1982 plan included a total of 8 projects in environmental protection controlled by the main office of the company, constituting 12.1 percent of the total number of projects. Investment of 3.22 million yuan was arranged, constituting 10.5 percent of total investment (not including investment in capital construction). In addition, each plant also included in its technical measures some environmental protection measures and projects.

3. In technical improvement, projects with outstanding economic and environmental benefits were grasped as key points to promote their realization. In this aspect, our methods were:

A. In technical improvement, we used new methods, new technology and renovated techniques so that pollution was eliminated as much as possible in the production process. The catalytic reproductive process of the catalytic cracking equipment at the Dongfanghong Oil Refinery produced 80,000 cubic meters of reproductive tail gas per hour containing 7 percent of carbon monoxide. This part of the reproductive tail gas was directed to the boiler as fuel and a part of it was used but each hour there were still 40,000 cubic meters of tail gas that was released into the atmosphere. This polluted the environment and wasted energy resources. The plant began in August, 1980, to use a carbon monoxide combustion supporter. The ignition point of carbon monoxide was lowered and the oxidation activity of carbon monoxide was improved so that it burned to form carbon dioxide under lower temperatures. The content of carbon monoxide dropped from the original 7 percent to about 0.2 percent. This recovered and utilized energy and also reduced atmospheric pollution. At the same time, it improved the effective activity and selectivity of the catalyst so that the distribution of products improved and the recovery rate of light oil products improved. The investment in this measure and the equipment was 3,000 yuan. Because a combustion supporter had to be supplemented, the ordinary annual cumulative operating cost was 160,000

yuan. The added production value could reach 30 million yuan, and the net profit could reach 15 million yuan. Because the content of carbon monoxide was reduced by a large scale, each day, 140 tons less of carbon monoxide were released into the atmosphere. After inspection, the content of carbon monoxide in the air in the area of the plant dropped from 4.52 milligrams/standard cubic meter to 2.31 milligrams/standard cubic meter, and the content in the residential area dropped from 4.09 milligrams/standard cubic meter to 2.46 milligrams/standard cubic meter. Environmental quality visibly improved. Also, this year, we included a project to improve the oxidation and dehydrogenation of butene and to improve the production of methyl cyanide at the Shengli Chemical Plant in the technical improvement projects of the company. The plant used a B-02 model catalyst developed by itself and changed the original fluidized bed reactor to a heat insulated fixed bed reactor. It was estimated that these measures would improve the product recovery rate from 50 percent to 71.6 percent and the selectivity could be improved from 72 percent to 92.4 percent. More importantly, the amount of compounds containing oxygen produced as a by-product could be reduced from 11 percent to 0.57 percent, basically solving the problem of separating organic compounds containing oxygen and pollution problems. After completing technical improvements, the level of production technology would be greatly elevated. The amount of butadiene produced can satisfy the needs for producing cis-butene rubber, and at the same time, this will have basically solved the problem of environmental pollution.

B. In technical improvement, equipment should be improved, the performance of the equipment should be raised, and the amount of pollutants should be reduced. The petrochemical enterprises own a large number of storage tanks for hydrocarbons. During the course of storing these hydrocarbon compounds, respiration and fumes release several hundred tons of materials into the atmosphere every day. To eliminate this type of pollution, the Dongfanghong Oil Refinery has been using new types of tanks soft sealed by a floating cap and tanks that have an arched top with an inner floating cap since 1978 to reduce loss of oil due to evaporation in the storing process, some visible results have been achieved. The content of hydrocarbon compounds in the air over the top of the containers dropped 30 to 3,000 times from the original amount. The quality of the surrounding atmosphere improved considerably. For several years, the plant has rebuilt 11 of the 34 light oil tanks with a capacity of over 1,000 cubic meters and 4 out of the 8 aromatic hydrocarbons storage containers of a capacity of over 500 cubic meters. After similar improvement of one gasoline tank with a capacity of 3,000 cubic meters, 200 tons of oil worth 100,000 yuan were saved each year. The plant plans similar improvements for the remaining storage tanks to realize further gains by conserving resources and reducing pollution.

In the course of chemical production, leakage is very common because of obsolete equipment and corrosion of the medium. At the phenol acetone facility of the Siangyang Chemical Plant, a high concentration of polluted water frequently "rushed" the treatment area. Besides poor management, the main causes were defects in equipment. Although the equipment had been rebuilt several times, good results could not be obtained. To prevent and control pollution and reduce the loss of materials, we are preparing to

continue technical improvements of the part of the facility for extracting phenol solution and related equipment, concentrating on pipes and meters centered around pretreatment of polluted water. According to estimates, if the average amount of materials released during the production of one ton of phenol acetone is reduced from 72.34 kilograms to 26 kilograms, then 410.41 tons less of phenol acetone worth 862,400 yuan will be released every year. A reduction in the loss of materials will create better conditions for treating polluted water.

C. In technical improvement, environmental protection and energy conservation should be combined to realize a combined gain in energy conservation and environmental protection. In 1980, the Dongfanghong Oil Refinery and the Shuguang Chemical Plant used advanced technology to develop energy conservation and environmental protection, completing a project to technically improve the torch. The original torch of the Dongfanghong Oil Refinery had a poorly-designed structure, the burning of combustible gases was not good, sometimes there was a lot of smoke. Each year, combustible gases equivalent to several thousand tons of fuel oil were burned away and a large amount of pollutants containing smoke dust and sulphur dioxide were released into the atmosphere, becoming one of the sources of serious pollution in the area of the Dongfanghong Oil Refinery. To conserve energy and reduce pollution, the Dongfanghong Oil Refinery built a low pressure gas storage and transport system including a 10,000 cubic meter gas tank and a low pressure gas recovery and utilization facility and designed and manufactured a smokeless low noise torch 80 meters high at an investment of 1.7 million yuan. Since the improvement facilities began operation, 300 to 700 cubic meters of low pressure gas have been recovered each hour throughout the plant. Under the lead of high pressure gas, the two boilers can completely utilize low pressure gas and the torch need not be lit in normal production. Each year, 6,000 tons of low pressure gas worth 300,000 yuan can be recovered and used. The content of hydrocarbon compounds in the air in the area of the plant was greatly reduced. The content of sulphur dioxide and noise in the area surrounding the torch were both within national standards. The Shuguang Chemical Plant is also prepared to further recover precious petrochemical raw materials such as ethylene and propene by cracking the tail gas of the wax burned away by the torch by rebuilding the torch. At present, construction of this technical improvement project has already begun by using funds allocated for environmental protection and comprehensive utilization projects. After completion of the measure, 5,000 to 7,500 tons of ethylene and 3,000 to 4,500 tons of propene can be recovered each year. These will increase the production value by 5 million yuan and profits by 4 million yuan. The resources that were originally sent to the torch and burned away can be used and their gain can be developed.

D. Wastes and by-products should be comprehensively utilized to recycle waste material and to turn harmful elements into beneficial ones. In the course of petrochemical production, many resources and energy are not fully utilized. They are released in various forms as waste and by-products and they cause environmental pollution. The Shuguang Chemical Plant releases more than 2,000 tons of waste each year in the course of producing alkyl benzene and lubricating oils (workers habitually call the waste "mud dregs").

Previously, these were abandoned or burned, wasting resources and polluting the environment. Since 1974, this plant thought of ways to recover benzene, aluminum trichloride and many types of oils from the "mud dregs." In 1981, a total of 2,700 tons of various types of materials were recovered worth more than 400,000 yuan. The Shengli Chemical Plant can recover 500 tons of butadiene worth 480,000 yuan each year from the tail gas of butadiene released by the plant. It has also recovered surplus oil and this can increase annual revenue by more than 30,000 yuan. These measures have used many resources that are wastes when abandoned but valuable when utilized.

Technical improvement work is a new road created by utilizing old enterprises to develop the national economy. It is also a good method of development by enterprises moving from "broadly defined intrafactory developmental measures" towards intensive developmental measures. Combining technical improvement to prevent and control environmental pollution is also an effective way of solving the problems of environmental protection. There are still many problems in our work and an overall plan is needed to include environmental protection plans. This requires an overall idea to unify environmental and economic gains. In addition, the gains need to be comprehensively analyzed and concretely measured and calculated.

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CSO: 5000/4057

SHENYANG SMELTER'S CHIEF ENGINEER DESCRIBES HIS PLANT'S POLLUTION CONTROL  
SUCCESES

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese, No 6, Jun 82,  
pp 2-5

[Article by Chen Chuntai [7115 2504 0669], Plant Manager and Chief Engineer  
of the Shenyang Smelting Plant: "How a Heavily Polluting Enterprise Handles  
Environmental Protection"]

[Text] The Shenyang Smelting Plant used to be a heavily polluting enterprise.  
After several years of great efforts, it achieved good results in preventing  
and controlling pollution and in protecting the environment. Some views on  
how this heavily polluting enterprise managed environmental protection well  
are presented in the following.

I. The Foremost Question Is To Clarify Responsibility, Improve Understanding,  
Select the Right Way

At the end of 1977, we conducted a general survey of the distribution of the  
main polluting sources throughout the plant and the concentration of  
pollution. The results showed that the annual amount of sulphur dioxide  
released by 37 chimneys (3 taller than 100 meters, 34 under 60 meters)  
reached 74,000 tons, constituting about 45 percent of the total amount  
released in Shenyang City. In the 27,000 cubic meters of waste water released  
each day, pollutants containing arsenic and heavy metals amounted to 377  
tons, and the amounts of copper, lead, zinc, cadmium and arsenic constituted  
29.7 percent, 34 percent, 67.2 percent, 82 percent and 100 percent of the  
total amounts released throughout Shenyang City. The damage caused by  
pollution was serious; the area of the plant was covered by dust and smoke,  
grass, flowers and trees could not grow, even people had difficulty  
breathing. Three hundred workers who came into contact with sulphur  
dioxide were examined, 30 percent suffered from varying degrees of tracheitis.  
The suburb of Zhangshitun Prefecture used the sewage water from the exposed  
sanitation canal containing our plant's waste water to irrigate farmland.  
As a result, the soil of 15,000 mu of land was polluted by cadmium, the  
cadmium content in the soil reached 3.7 ppm. The rice produced from 6,000 mu  
of the contaminated rice fields had a cadmium content 10 times the standard  
and the rice could not be consumed.

Facing the reality of such heavy pollution, we launched propaganda and educational activities in environmental protection in depth and gradually unified understanding throughout the plant in the following aspects:

(1) Strengthening environmental protection and realizing efficient production are determined by the socialist nature of enterprises. They are required by the goals of socialist production, they are important contents of business management. (2) Strengthening environmental protection by metallurgical enterprises is protecting precious resources of the state. (3) Strengthening environmental protection and realizing efficient production are the main goals of building modernization. (4) Strengthening environmental protection and conserving energy are the central links in improving old enterprises. In general, strengthening environmental protection is our inescapable duty. Especially enterprises like ours which are "heavily in debt" in managing pollution, should quickly control pollution, pay off the "debts" for the benefit of future generations.

There were three ways to solve the pollution at the smelting plant. One was moving the plant to a mountain valley; the second was to introduce foreign technology and ask foreigners to help; the third was to mobilize the masses, and solve the problem independently. After repeated study and trials, the first two ways could not be followed and the practical way was the third way.

The key to solving pollution independently was to select a plan that was both effective and economical. For this, we concretely analyzed and studied the causes that form the polluting sources and the nature of pollution. He believed that whether it is pollution by waste gases, waste water or waste slag, there were only two polluting sources: One was the technology and the equipment themselves, and the other was management and people. The nature of pollution can also be divided into two major corresponding categories; one category was pollution by technology and equipment, the other was pollution caused by management. Pollution by technology and equipment refers to pollution by the three wastes necessarily produced by production techniques and the facilities themselves at the present technical level of production. What we call pollution by management responsibility refers to man-made pollution caused by poor business management. There should be different plans and measures to prevent and control pollution of different natures. Generally speaking, pollution by technology and equipment is mainly controlled by treatment supplemented by management. Pollution by management responsibility is mainly controlled by management supplemented by treatment. Combining management and treatment is an effective way to solve pollution self-reliantly.

## II. The Key Problem Is To Establish a Sound and Complete Environmental Management Procedure and a Management System

Practice proves that strengthening management is the most economical way to prevent and control pollution, and the only effective way to control industrial pollution and pollution caused by poor business management.



Therefore we established an environmental protection system of three levels including the plant, the shops and the work shift. An environmental protection office was established at the plant level; environmental work sections were established in the shops and special environmental protection engineers were assigned; environmental protection workers were assigned to the work shifts. Subordinate to the environmental protection office of the plant were an environmental monitoring station, an environmental management station, an atmospheric group, a water quality group and a comprehensive group. A strong team of cadres was assigned; a fairly large number of engineers and technicians with real talent and knowledge were added. The environmental protection office of the plant had its duties, responsibilities and authority; it was the command center of environmental work throughout the plant led by the plant manager. The environmental protection office was the nucleus; the department of plant planning, production, technology, equipment, energy, finance, engineering and supply all included environmental protection as the key work of their own departments. The whole plant formed an environmental protection management network that combined the higher and lower echelons and combined the masses with the professionals.

As the management body was formed, a management system was gradually established and perfected. There were six main management systems, "the environmental protection rules of the Shneyang Smelting Plant," the "duties of environmental protection offices," the "detailed responsibilities for inspecting and examining environmental pollution," the "system for sewage management," the "system for smoke and gas management," and the "management system for greening and beautifying the plant." On this basis, we concentrated on the following six aspects in management during the course of carrying out the system:

1. In the management of production techniques, we revised the past rules of caring only about production and neglecting production techniques and operations in environmental protection. We added technological and technical conditions for the prevention and control of pollution and for environmental protection and established economic and technical quotas. We rationally organized and arranged production to eliminate pollution in technological processes. For example, the production of indium was included in the treatment shop for copper and lead anodic mud in the past; the waste water containing cadmium was difficult to treat. Later, we moved the extraction of indium into the zinc smelting shop; the waste water containing cadmium was recycled back into the production system. Cadmium was extracted in the cadmium work section and pollution was eliminated.

2. In the management of equipment, we emphasized the quality of installation and equipment maintenance and prevented leakage. At the same time, we recovered dust, smoke and gases. The treatment of sewage and comprehensive utilization facilities were combined into one environmental protection facility and special personnel were assigned to take charge of management. When we started operating the production equipment, the environmental protection equipment must be started first or simultaneously. When the environmental protection equipment broke down, it must be repaired in time.

3. In the management of energy, we enforced the quota system for the consumption of oil and coal and controlled black smoke. At the same time, we stressed the conservation of water. Waste water from technological processes that affected production was treated and inspected before it was released; waste water that did not greatly affect production was recycled back into the production system or recycled for use. Waste water from the cooling equipment was re-cooled in the cooling tower and recycled for use. For example, the waste water that was produced in the process of using water to recover dust from the smelting of lead and that contained cadmium was returned together with the ash for sintering and mixing. The slag water from copper and lead punching was recycled in a closed loop; in winter, this water was used to generate heat.

4. The management of resources, we fully developed the superiority of this comprehensive smelting plant. The ash or residual slag produced in one shop was sent to another shop to extract the valuable metals in them; this eliminated pollution and also comprehensively utilized resources.

5. In labor management, we emphasized the implementation of the system of personal responsibility. We eliminated the discharge of pollutants caused by dereliction of duty.

6. In environmental management, we stressed monitoring, inspection, environmental quality evaluation, environmental and economic analysis, beautification and sanitation of the plant and implemented the rewards and punishment system.

Strictly implementing the various systems and concentrating on the six managerial tasks described above were very effective in controlling pollution due to technology and equipment and in eliminating pollution due to management responsibility. At the same time, they also had a definite function in strengthening business management.

### III. The Central Problem Is To Select the Most Economical Plan of Prevention and Control

Strengthening management mentioned above is the most economical plan; we can cite two examples to further explain this problem. One is the retrieval of high concentrations of sulphur dioxide to make acid. The five sets of acid manufacturing systems at our plant can treat 130,000 to 140,000 standard cubic meters of smoke every hour. When we consider a 30 percent leakage rate for the system, only 100,000 standard cubic meters of smoke from smelting can be truly recovered. This means, we can exhaust the smoke from smelting copper but to recover the sulphur dioxide from the smoke from smelting lead, we still need to build another acid manufacturing system. But if we strengthen management, reduce leakage, reduce the amount of smoke from smelting to 110,000, the leakage rate of the system can be reduced 25 percent, and the five acid manufacturing systems can completely recover the highly concentrated sulphur dioxide smoke. If we strengthen management further and reduce the amount of smoke to 100,000 and the leakage rate to 15 percent, the acid manufacturing ability can be elevated another 5 percent. Thus, four

acid manufacturing systems will be able to treat all of the smoke and one system can be set aside as a reserve during inspection and repairs. In this way, elimination of pollution by smoke with a high concentration of sulphur dioxide can be guaranteed. The other example is the treatment of water. At the beginning of 1978, the whole plant released 27,000 cubic meters of waste water, of this, 2,400 cubic meters of water were heavily polluted. It was not possible to treat such a large quantity in a centralized manner. Later, we cleaned the pollutants, divided the flow, recycled the water for use and stopped leakage, reducing the amount of waste water released to 11,000 cubic meters. Only 450 cubic meters of the water were heavily polluted. We originally intended to build a sewage treatment station to treat the water centrally; estimated showed that this required an investment of 4 million yuan and there were no technical problems. But economic analysis showed that centralized treatment was not as good as scattered treatment. As a result, we followed the principle that whoever pollutes is responsible for treating it; each shop treated its waste water separately. Total investment was only some 200,000 yuan, and in less than half a year, the amount of waste water released by the whole plant met the state requirements for the release of waste water.

The two examples above show that strengthening management and spending little or no money can realize good results. During the course of treating pollution, we should pay more attention to selecting the most economical plan. When we began studying the plan for treating pollution by technology and equipment, we believed that we should use new and advanced technology and equipment as much as possible, and should make major changes. Later, we went to Japan to investigate and discovered that some of their old enterprises did not rely on major changes to solve the problem of pollution. They also made improvements at the locality but the problem of pollution was indeed solved. By learning the Japanese experience and combining national conditions and plant conditions, our plant held 54 economic and technical discussion meetings, and basically determined the plan for environmental protection and improvement.

The treatment of sulphur dioxide pollution was realized mainly by further strengthening smelting techniques, for example, the use of oxygen enriched smelting to further increase the concentration of sulphur dioxide in the smoke, reducing the amount of smoke, and direct retrieval to manufacture acid. The problem of a high concentration of arsenic in the smoke was solved by scientific research and experiments using activated carbon adsorption and by further perfecting the flow process of the dry method in manufacturing acid. We built a project to recover low concentrations of sulphur dioxide and completely recovered smoke with a low concentration of sulphur dioxide from the tail gas produced by the lead smelting system and in acid manufacturing. The treatment of sewage was done mainly using the neutralization method. First level treatment was completed in each shop, i.e., after purification reached the criteria for release, second level treatment by the plant satisfied the standards for ground surface water. The comprehensive utilization of waste slag, i.e., the furnace slag from the lead blast furnace was done by using the technique of the smoke-making furnace. At present, the project has been

basically determined, and some parts are being built. It is expected that by 1985, pollution of the smelting plant will be basically treated.

Using many ways to gather capital and to develop the use of capital as much as possible are also an important link in selecting the most economical plan to prevent and control pollution. Our methods were: One was to combine funds for major repairs of the enterprise, funds for renovation and improvement and profits from treating the three wastes. We broke away from the past frame of mind of following the same methods. We utilized the annual opportunity for major repairs to implement the principle of "major repairs and major improvements, small repairs and small improvements, and improvements whenever repairs are done," and carried out improvements according to plan and in an organized manner. The second was to use environmental protection to stimulate comprehensive utilization and to use comprehensive utilization to assure environmental protection. Just by retrieving sulphur dioxide to manufacture acid alone realized an income of nearly 4 million yuan, providing funds for further treatment of other types of pollution.

#### IV. The Fundamental Problem Is in Strengthening Leadership and Mobilizing the Masses

In strengthening leadership and mobilizing the masses, we should stress five links.

First, we must emphasize the implementation of the political line, the organizational line and the ideological line of our party since the Third Plenum of the 11th Party Congress. Enterprises should regard the prevention and control of pollution and environmental protection as important tasks in realizing modernization. Thoughts must be liberated in work; the policies of the party must be implemented in organization. All active factors must be fully mobilized. Joint efforts must be carried out to realize the goal of "a blue sky and clear water, and efficient production."

The second is to stress the implementation of the state's environmental protection law and related regulations of the local governments. We should launch propaganda and educational activities in environmental protection in depth so that every worker will protect the environment by following and abiding by the law.

Third, we must draw up plans and act in unison. The plant has a five-year plan and an eight-year long-range plan; it also has concrete annual plans. After the plans have been passed by the worker representatives conference, each unit must conscientiously carry them out.

Fourth, we must emphasize the environmental protection responsibility system and link it with the economic responsibility system. The enterprises should include environmental protection as a major content when implementing the economic responsibility system and launching labor competition. Those who contribute to environmental protection must be rewarded and those who pollute must be punished.

Fifth, we should concentrate on organizational leadership and technical leadership. The main leaders of the units subordinate to the plant should emphasize environmental protection themselves. The environmental protection engineers of the plant's environmental protection office and the units subordinate to the plant and other engineers and technicians should personally go to the shops and the shifts, concretely organize and guide the prevention and control of pollution and environmental protection work.

The above introduced some of the methods and experience of the Shenyang Smelting Plant in preventing and controlling pollution and in environmental protection. Generally speaking, they are the following: A heavily polluting enterprise that wants to protect the environment well should be self-reliant, make renovations and improvements, combine management and control, pay attention to practical results, and use the most economical plan to prevent and control pollution. This can unify environmental results and economic gain. Concrete results and progress realized over the past several years are listed in the following table.

Achievements and Progress in Environmental Protection Realized by the Shenyang Smelting Plant

Major Indicators	Unit of Measure	1977	1978	1979	1980	1981
Amount of SO released	ton	74,200	67,000	50,000	36,000	34,500
Total amount of dust released	ton		2,016	1,334	1,100	1,064
Amount of dust falling in plant area	ton/square kilometer·month			60	35	47
Amount of sewage released	ton/day	31,000	25,500	21,400	15,590	11,300
Amount of arsenic and heavy metals carried away by sewage	ton		377	336	175	15
Amount of sulphuric acid produced	ton	63,000	75,800	88,500	113,600	111,834
Sulphur's comprehensive utilization	%	36.0	46.3	54.0	65.3	66.3
Comprehensive utilization of valuable elements	%					
Rate of utilization of resources	%	33.0	44.5	52.9	61.5	63.0
Rate of utilization of recycled water	%	68.0			82.0	83.5
Rate of utilization of energy	%	31.4	43.8	55.7	75.5	80
Percentage of good equipment	%	21.6			29.3	31.6
Percentage of areas that can be greened	%	85.7	89.6	90.3	89.5	91
Total value of industrial production	10,000 yuan	40,502	47,866	50,376	55,342	53,825
Net production value	10,000 yuan	5,652	6,817	8,387	9,684	9,647
Profits realized	10,000 yuan	2,270	3,255	4,305	5,332	5,416

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CSO: 5000/4057

## SHANGHAI STEPS UP POLLUTION-CONTROL EFFORTS

OW111006 Beijing XINHUA in English 0746 GMT 11 Oct 82

[Text] Shanghai, 11 October (XINHUA)--The Shanghai Municipal Government has ordered 662 factories to control all their industrial pollution within eight years, according to the Municipal Environmental Protection Bureau. These factories include old paper mills, tanneries, electroplating factories and printing and dyeing mills. The order is part of a plan for China's largest industrial city to control pollution under the "Environmental Protection Law."

By 1985, the center of the city proper is expected to be free from smoke pollution and the average noise level cut by three decibels. Pollutant content in waste water discharged by factories along the city's Huangpu River is scheduled to be reduced below the required level by 1990.

Since enactment of the "Environmental Protection Law" in 1979, the spokesman said, the bureau has charged some factories and warned 150 others to control pollution by a given time.

The municipal government has allocated 100 million yuan to help factories control pollution, he said. As a result, Shanghai's waste water treatment capacity rose 51 percent over that of 1980, following the installation of about 1,000 treatment units in factories.

In addition, almost no black smoke is now discharged in the urban area by boilers with a capacity exceeding one ton. Installation of central heating systems in 70 factories reduced the chimney number by 50. Nine of the 17 metallurgical furnaces and plants discharging clouds of yellow smoke have been brought under control, the spokesman said.

Over the past four years, for example, the Shanghai Oil Refinery has spent 12 million yuan on pollution control, 38 percent of which was allocated by the government as a result of technological revamping. The refinery now treats 99 percent of its waste gas and 98 percent of its waste water. Four years ago, the refinery discharged an average of 300,000 tons of oily water and 20 kinds of harmful gases daily.

While controlling pollution caused by existing factories, the spokesman said, the Municipal Environmental Protection Bureau takes measures to prevent additional

pollution from new, expanded or rebuilt factories. The bureau ensured that 5.9 percent of 2.9 billion yuan invested in 1,800 construction projects from 1977 to 1981 was spent on pollution control. This has permitted installation of pollution control facilities along with construction of the principal parts of these projects, he said.

CSO: 5000/4107



# SHANGHAI STEEL MILL NO 3 HALTS PRODUCTION TO INTALL ANTI-POLLUTION EQUIPMENT

Shanghai WEN HUI BAO in Chinese, 30 May 82 p 1

[Article by Zhang Debao [1728 1795 1405]

(Editor's Note): It is summer, and some factories in the metropolitan area which had not been able to control the discharge of pollutants have been facing mounting resentment of the area residents. The Shanghai Steel Mill No 3 has decided to stop production to install anti-pollution equipment and resolved to look for other means to recoup the losses thus sustained. The residents of the Zhoujiadu area have also come forward like responsible proprietors to help the mill control the discharge of pollutants. Their spirit of voluntary help is indeed praiseworthy.

[Text] To control environmmetal pollution near Zhoujiadu, Pudong, the municipal Bureau of Metallurgical Industry has given the Shanghai Steel Mill No 3 approval to stop its smelting furnace to install anti-pollutant equipment, and the residents of the factory zone, motivated by their concern for the interests of all, are supporting the mill to improve environmental quality and develop production.

The open-hearth furnace workshop of the Shanghai Steel Mill No 3, one of the oldest in the area, was built in 1914. Since the introduction of oxygen steelmaking in the 1970's, its annual output has gone from 200 thousand tons to 500 thousand tons. Handicapped by the restrictive layout of the original plant construction, parts of its manufacturing facilities have spread to the boundary lines of the factory zone, and the pollutants discharged during operation, especially smoke and dust from its smelting furnace, have become an environmental hazard to the nearby residents. The municipal Bureau of Metallurgical Industry has decided to set aside more than 2 million yuan to install anti-pollutant equipment to eliminate the dust from smelting in the open-hearth furnace workshop.

In view of increasing production tasks undertaken by the metallurgical industry of the city, the Shanghai Steel Mill No 3 realized the discharge of pollutants would increase if it goes ahead as planned to install the antipollution equipment while production goes on as usual. After careful consideration by the local authorities and the mill, it decided with the approval of the higher authorities, to stop smelting when it installs the

anti-pollution equipment so that no pollutants would be discharged to disrupt the lives of the residents.

The stoppage of production will cut down steel production by more than 20,000 tons. Unwilling to let the state sustain such losses on the one hand and to disrupt the lives of residents on the other, the staff and workers of the Shanghai Steel Mill No 3 are ready to do their best to recoup the loss of steel production sustained by stopping production.

To work with and support the mill in its anti-pollution efforts, the people's government of the Nanshi area and the responsible cadres of the streets of Zhoujiadu have launched recurrent propaganda drives among the residents and circulated printed propaganda material in the area. The residents close to the factory zone are also very supportive of the anti-pollution measures of the mill. Some residents who once proposed removing the plant, due to the instructive propaganda, realize now that the incident ought to be handled more reasonably. They are convinced that coordinated planning for urban improvement would benefit the state, the collective and the individual, and that since the mill has stopped production to control the pollutants and improve the environment for the good of the residents, they should support the mill to control pollution and develop production.

Now, the Shanghai Steel Mill No 3 has shipped in the anti-pollution equipment for the smelting furnace in the open-hearth workshop and began construction work outside the factory. The installation of the equipment will begin in the latter part of the month and be completed in about one month.

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CSO: 5000/4049

## SHAANXI DEFENSE INDUSTRIES WIN HIGH MARKS IN ENVIRONMENTAL PROTECTION

Xi'an SHAANXI RIBAO in Chinese, 24 May 82 p 1

[Article by Wang Chao [3769 6389], Wang Hongying [3769 7703 7751], and Ren Shide [0117 0013 1795]:

[Text] In tightening up pollution controls and concentrating on resolving certain specific problems of pollution, the national defense industrial complex in Shaanxi has achieved remarkable successes in improving environmental quality and enhancing culture and production.

Aided by their study of the "Environmental Protection Law" and the "Decision" of the State Council on strengthening environmental protection, the staff and workers of the national defense industrial complex have voluntarily incorporated environmental protection with social construction, and set out to teach the masses to make it "an honor to protect the environment." All its component parts, including its subordinate bureaus and enterprises, have succeeded in making the organization, personnel, funding and planning of their environmental protection work practicable. Many units have worked out realistic pollution control rules, including supervision and testing, levy of fees for exceeding established limits, and environmental protection files. Other units have even set up special organs for environmental supervision and surveying.

The complex sets aside funds earmarked exclusively for pollution control, making adequate funding of the work a top priority. There are units which use the capital they raise to finance pollution control before everything else. According to tentative statistical reports of 76 units, they have invested over 23.6 million yuan to treat the "three wastes" during the last 4 years. Last year all the departments of the Third Ministry of Machine Building were able to raise over 87 percent of the total investment in the facilities for treating the "three wastes." In recent years, the Northwest Machine Factory has been setting aside each year a sum of 100,000 yuan out of its funds for innovations to control pollution and beautify the plant. With its level of smoke and dust discharge below the limits set by the state and with more than 70 percent of factory zone covered with greenery, it has become known as a "garden factory." The Dongfeng Machine Factory has been named by the local city people's government as the cleanest factory in the city.

Making the treatment of the "three wastes" the key to environmental protection, the national defense industrial complex has launched an extensive drive for technological improvement and innovation and to conserve energy and natural resources in order to control the discharge of the "three wastes." According to statistics covering the major plants, comparing 1981 with 1977, the amount of sewage discharge decreased 27.7 percent, waste gas decreased 59.7 percent and waste residue decreased 3.15 percent. The excess gas discharged by the Shaanxi Diesel Machine Factory which used to pollute the air in the neighborhood is fully utilized now to eliminate pollution and to provide gas for household use by the staff and workers of the plant.

The industrial complex has been successful in treating within set time limits the most serious pollution items one by one. It also worked with the provincial environmental protection department and other related agencies to run a general inspection of its projects listed under the first national, provincial and municipal programs of pollution control within specified time limit and other key pollution control units. Of the 25 projects of pollution control within the time limit set by the state, 22 were able to meet the deadline. The Qinghua Electrical Appliances Plant was able not only to complete its 7 projects of pollution control within the time limit set by the state but also 8 other projects. These have improved the environmental quality considerably.

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CSO: 5000/4057

## PETROCHEMICAL PLANT CONCENTRATES ON ENVIRONMENTAL PROTECTION

Guangzhou GUANGZHOU RIBAO in Chinese 12 Jun 82 p 2

[Article by Chen Lu [7115 2924] and Dai Rensheng [2071 0088 0581]]

[Text] The Guangzhou Petrochemical Plant was commended not long ago by the provincial environmental protection office for its success in treating the "three wastes" and protecting the environment by recycling its waste residue, waste gas and waste water to reuse energy and by-products. The petrochemical plant, as designed, was expected to discharge during operation an annual total of 800 million cubic meters of harmful carbon monoxide, 17.22 million tons of industrial and household sewage, and 22,400 tons of waste residue. If these "three wastes" were not treated, they would lead to serious environmental pollution harmful to the health of the masses. To turn waste into valuable products, the plant not long after it started production began to recycle all the harmful sulphide discharged by its vacuum distillation facilities and use it as fuel in its heating furnace. This not only cuts down pollution and eliminates offensive odors, but also recaptures gas equivalent to more than 4,000 tons of fuel oil per year. Now, the plant is capable of treating all its harmful gas and waste residues, and still keep the waste gas discharged during the treatment within the limits set by the state. Its treatment of industrial sewage has for the most part reached the standard prescribed by the state. Lately, a test conducted by a higher environmental protection supervision agency attests that the groundwater at the plant contains no noticeable pollutants, and the atmosphere at and near the plant has been healthful. For more than 3 years, the plant has recaptured from its waste residues, waste gas and waste water, 33,400 tons of fuel oil, 6,560 tons of polluted oil, 3,032 tons of sulphur, 689 tons of sodium carbonate, 150 tons of cyclic alkyl acid and 14,000 tons of fuel gas. These are worth 3,792,000 yuan, a feat which combines economic and environmental protection benefits.

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CSO: 5000/4054

## DISRUPTION OF ECOLOGICAL BALANCE OPENS DOOR FOR ENCROACHING DESERT

Beijing DIQIU [EARTH] in Chinese No 3, 1982 pp 6-7

[Article by Wang Wufeng [3769 2976 1496]: The Destruction of Ecological Balance]

[Text] Ecological balance is the natural system of ecological distribution of all the living things in nature. Any disruption of this natural ecological distribution would set in motion a series of devastating responses. For instance, destruction of the forest resources of a region would affect its climate and water supply, causing soil erosion and possible destruction of wild animals. Vegetation is a lever for maintaining ecological balance and a natural agent for water and soil conservation. Its destruction could lead to grave consequences. The area of the world's forests has shrunk in the past 120 years from 7.6 billion hectares to 2.6 billion hectares, causing an average annual loss of 2.4 billion tons of soil. China is poor in forest resources, ranking 120th in the world. Due to extensive cutting and destruction of vegetation year after year, we lose an average of 5 billion tons of soil every year. Sichuan, known as "the land of abundance," is rich in forest resources (ranking second in China) which serves as a "green great wall" to guard the climatic and hydrological environment and to conserve water and soil.

Extensive felling and the destruction of the virgin forest zones in Sichuan during the last couple of decades have led to severe loss of water and soil erosion which covers 20 percent of the Chang jiang basin and represents 2.4 billion tons of eroded soil. As a lever for maintaining ecological balances, vegetation has contributed to the natural ecological balance in the northwest and northeast of China where there are 3.3 billion mou of grassland, enough to feed 25 million head of cattle. But due to severe destruction, there are 1 billion mou of grassland facing degeneration, desertization and alkalization, causing a decline in livestock production and in the development of animal husbandry.

The disruption of ecological balance has led to ever worsening desertization and alkalization of soil. 6 million hectares, or 90 million mou of arable land is being lost to the desert every year. China is a country with extensive deserts. The area of the deserts has increased by 1.9 billion mou in the last

30 years. There are about 1 billion mou of arable land threatened by desertization and another million mou threatened by varying degrees of alkalization. Today, the threat of desertization is so serious that the United Nations has even marked out Beijing, the capital, as a region threatened by desertization.

#### The Consequences of Large-scale Industrialization

The speedy development of science and technology and the spectacular growth of large-scale modern industrial production have given rise to a rapid increase of urban population and the emergence of new cities and transportation facilities. But they have also led mankind to face many insurmountable problems, especially extensive occupation of farmland by industry and environmental pollution, a new threat to land resources. According to statistical reports, the capital urban industrial and transportation construction in China during the two decades between 1958 and 1978 has taken over 500 million mou of farmland, a 25 million mou cutback in area per year, or an annual loss of farmland equal to the area of arable land of Zhejiang Province, this is very serious even in a capitalist country. In the United States for example, the land used for capital urban industrial and transportation facilities is 31.9 percent of the total land area of the whole country, or 2.98 million square kilometers, an equivalent of 4.47 billion mou. To resolve the contradiction between land for urban transportation, industry and mining on the one hand and the land for agriculture on the other will no doubt be the most critical issue in the future of urban industrial and transportation development.

The rapid development of large-scale modern industry has seriously polluted the environment; the land, the air and food has been polluted. According to statistics, we discharge over 70 million tons of industrial sewage per day, 95 percent of which empty into the rivers, lakes and the sea without treatment, causing water pollution. The use of polluted water for irrigating farm crops leads to food poisoning. For instance, some 6 thousand mou of farmland in the Shenyang and Fushun irrigation zone, Liaoning Province, are polluted by industrial waste water. As a result, the rice produced there contains 2.6mg/kg of cadmium. In Japan, any locality which produces crops containing over 1mg/kg of cadmium is prohibited by law to grow grains because grain which contains 1.41mg/kg of cadmium would cause bone disease, a serious health hazard. In short, there are as many causes for the crisis in land resources as there are solutions to the problem. As long as we all pay close attention to the problem, man will be able to find a way to resolve it.

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CSO: 5000/4057

## COMMENTARY BEMOANS UNRESTRICTED DEPLETION OF FORESTRY RESOURCES

Beijing GUANGMING RIBAO in Chinese, 17 Jun 82 p 1

[Text] Since the latter part of last year, the destructive practice of random felling of trees and unlawful occupation of state and collectively owned wooded mountains have resurfaced in certain localities. Why do these evil practices resurface or even persist in some localities? The crucial point is that the major programs, policies, regulations, and measures on developing forestry have not been fully implemented and the cadres and masses do not have an ideologically correct understanding of the problem. The leadership of some localities and departments concerned is so weak that it hesitates to tackle and clamp down on unlawful destruction of forests. If these problems remain unresolved, the current random felling of trees will continue and may very well lead to more extensive destruction. The leadership at all levels should pay close attention to the situation. Poorly endowed with forests as China is, unrestricted felling of trees all these years has drained our vitality. Up till now, not much has been done to arrest the depletion of forest resources in many areas. If this continues, it will threaten the Four Modernizations and endanger the interests of future generations. The most urgent task right now is to protect, restore and develop forestry.

It takes a variety of coordinated measures to uproot the current evil practice of random felling of trees and to restore order and stability in the forest zones. The most urgent matter is to stop the evil practice of random felling of trees in some localities. All localities should launch extensive propaganda campaigns to drive home the importance of protecting and developing forestry, and to publicize the forestry policy and regulations of the state. Work continually to implement the "three assigned quotas" for forestry and resolve the problem of authority, responsibility and interests. Investigate and punish those cadres who tolerate, support and lead the destruction of forests, and violate the law they are expected to enforce. Punish those criminally liable in accordance with the law. Mobilize the masses to form forest protection teams and sign forest protection covenants. Reward any advanced unit or individual who loves and protects the forests, criticize selfish and unlawful destruction of forests, make it an honor to love and protect the forests, and a disgrace to destroy them unlawfully.

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CSO: 5000/4053



## MINISTRY OF FORESTRY HOLDS MEETING TO STUDY RANDOM DEFORESTATION

Beijing GUANGMING RIBAO in Chinese, 17 Jun 82 p 1

[Text] A meeting of the representatives of the forestry departments (bureaus) of eight provinces and regions, including Guizhou, Yunnan, Guangdong, Guangxi, Hunan, Fujian, Jiangxi, and Zhenjiang, was held 8-11 June by the Ministry of Forestry to study random felling of trees in some localities and the ways to prevent it.

All those at the eight-province meeting felt that the "emergency Circular on Checking Random Felling of Trees" issued on 5 December 1980 by the State Council and the "Decision on Protecting and Developing Forestry" issued on 8 March 1981 by the Chinese Communist Party Central Committee and the State Council have alerted all localities and basically put an end to the random felling of trees throughout China. But the practice has resurfaced since the latter part of 1981, and the situation has become quite serious in a small number of localities. Many collectively owned forests have been completely cut down and divided up, large areas of state owned forests have been occupied and destroyed by neighboring communes, production brigades and the masses. In Huaihua, Hunan, 33 thousand cubic meters of lumber and 28 thousand bamboo trees have been cut down since the beginning of this year. In Chunan, Zhejiang, there were 106 instances of reckless felling of trees, totalling 9900 cubic meters of lumber, between January 1981 to April of this year. There were 198 cases of random felling of trees in Wengan county, Guizhou, where some production brigades have deforested practically all the wooded mountains. Last year in Guangxi over 400 thousand mou of wooded mountains in 152 state-run tree farms were occupied, raided and deforested, injuring over 180 forest maintenance crew and police. Over 15 thousand mou of China fir in the Lianghua state-run tree farm in Guangdong have been felled and stolen in recent years by neighboring communes, production brigades and the masses, a loss of 45 thousand cubic meters of fir. The free lumber markets in many forest zones once shut down are in business again to trade and smuggle private lumber. The 20 free lumber markets in Taizhou, Zhejiang, handled the sale of 37 thousand cubic meters of lumber in 1981. The violent seizure of state owned lumber has been prevalent. Representatives at the meeting have studied the causes of random felling of trees in certain localities and have worked out concrete measures to bring it to an end.

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CSO: 5000/4057

## YUNNAN DESIGNATES JUNE AS TREE-PLANTING MONTH

Kunming YUNNAN RIBAO in Chinese, 2 Jun 82 p 1

[Text] In view of the natural climatic conditions of Yunnan, the resolution of the 12th session of the Standing Committee of the Provincial People's Congress which met in the spring this year to designate June as the "Tree-Planting Month" is wise and conducive to better afforestation. Now, as Yunnan begins to observe its first tree-planting month, all the localities must carry out resolutely the instructions on afforestation issued by the State Council and those by the provincial party committee and the provincial people's government, and do their utmost to make the first "Tree-Planting Month" a success.

Propaganda and education work must be carried out conscientiously. First of all, launch an intensive propaganda drive based on the successes and failures of the past to drive home the importance and urgency of afforestation. Make the cadres and the masses of all the nationalities see in terms of personal interest that the best way to bring prosperity to the peasants, especially peasants of the mountainous regions, is to develop forestry and turn the natural potentials of the province favorable to the development of forestry into economic gains. Foster the enthusiasm of the people of Yunnan to promote afforestation and bring into play the traditional virtue of loving and caring for forestry. Furthermore, extensive propaganda is needed to explain that the choice of June as the "Tree-Planting Month" is based on the climate of the province. "Young trees have a better chance of survival in the rainy season, don't let the opportunity slip away. "Trees planted in the summer have a higher survival rate than those planted in the spring. People of all nationalities in Yunnan, both young and old, workers, peasants, soldiers, intellectuals and merchants in both urban and rural areas, should be informed that June is "tree-planting month," and they should take part in the drive to plant trees in an enthusiastic, conscientious and organized manner.

Those localities still lagging behind in afforestation should carry out on time what has been planned. Get the seeds, seedlings and saplings ready and properly distributed to make every individual and every grassroot until braced for tree-planting so as to accomplish fully or substantially the whole year's task during the rainy season. Strive for results and quality of

afforestation instead of window-dressing formalities, strengthen inspection and responsible management, and prevent as much loss as possible to raise the rate of survival. The weather this year has been abnormal, lack of seasonable rainfall may delay tree-planting in some localities; this could lead to conflicts between afforestation and farming. Proper scheduling should be worked out to accommodate both.

As we press for afforestation, we must also stop deforestation and random felling of trees for reclamation. "The two systems of full responsibility" had moved so fast in certain localities that forestry management was unable to keep pace. The "three assigned quotas" for forestry misunderstood by the masses in some localities has led to a new wave of raids on state forests and deforestation for reclamation. The most effective way to do away with random felling of trees and deforestation for reclamation is to carry out resolutely the instructions given in the circular of the provincial party committee. Investigate and resolve each case in all earnest, and punish the offenders in accordance with the law; let the law control forestry. All those localities which have established the "three assigned quotas" for forestry should resolve all other remaining problems in order to clarify the policy and win firm public support. After the busy planting season, all party and government agencies at the county level should organize vigorous work teams to assist the communes and production brigades of those localities which have not yet begun the system to get it established. The program must reach the specified quality and quantity within the current year as required by the circular of the provincial party committee.

Tree-planting, forest protection and full afforestation by the people is a long-term construction program which requires perseverance and scientific approach. Now it is June. The leading party and government agencies should promptly plan for mobilization, execution and inspection of the afforestation activities in Yunnan and do everything possible to make the first tree-planting month a success.

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CSO: 5000/4057

YUNNAN PROVINCIAL PARTY COMMITTEE ISSUES CIRCULAR ON PROTECTING FORESTS

Kunming YUNNAN RIBAO in Chinese, 27 May 82 p 1

[Text] In its recently issued circular on "The Protection of Forests and Prevention of the Destruction of Forests for Reclamation," the Chinese Communist Yunnan Provincial Party Committee asked all the localities, including prefecture, city and county party committees, and the party organs of all related departments to investigate the implementation of the directives on protecting forests, preventing the destruction of forests for reclamation and to check further destruction of forests.

The circular states that in spite of what Yunnan had accomplished in enforcing the "Forest Law" and the directives on protecting and developing forests and on preventing the destruction of forests for reclamation issued by the Party Central Committee, the State Council, the provincial party committee and the provincial people's government, no thoroughgoing solution has yet been found to the problem of forest destruction. As reported by those in charge, the problem of destroying forests for reclamation still haunts certain localities. The leading comrade of the Party Central Committee therefore issued on 23 April a written directive to the leading comrade of the Yunnan provincial party committee that "only by persistent efforts could we resolve the problem of forest destruction." Another leading comrade of the Party Central Committee who had come to Yunnan to inspect party operations pointed out precisely that the most urgent task on hand is to stop further destruction of forests for reclamation. He reiterated again and again that the problem confronting forestry is quite serious and should be resolved realistically and effectively. Another leading comrade of the Party Central Committee who toured Yunnan also said that the problem of forestry ought to be resolved the sooner the better. The crucial issue, according to him, is the lack of a clarification of forest rights; once forest rights are resolved, all other problems relating to forestry would be easy to handle. Problems concerning felling of trees, afforestation and processing are all forest rights. He also discussed how to protect the forest resources of Xishuangbanna, and how to utilize and develop its natural potentials.

The circular states that the provincial party committee is of the opinion that to carry out the directives of the State Council and the instructions of leading comrade of the Party Central Committee, it is necessary to investigate

how they have been implemented, sum up the experience, adopt even more effective measures, and work persistently until the problems are resolved. It asks for the following actions:

1. The party committees of all the localities, including prefecture, cities and counties, and the departments concerned, including the provincial department of forestry, must conduct thorough investigations on the implementation of the directives and policies on protecting and developing forestry issued by the Party Central Committee, the State Council, the provincial party committee and the provincial people's government; analyze the condition of forest destruction, sum up the experience, and adopt effective measures to resolve the problems as they are being investigated. Reward those who have done well; those who have failed to do well should be criticized and asked to make corrections within set time limits.
2. Act firmly to check destruction of forests for reclamation which is still in progress. Investigate case by case incidences of forest destruction and forest fires, and punish the offenders accordingly. Be resolved to prevent further destruction of forests for reclamation.
3. From the standpoint of existing conditions, a lot has to be done to establish the "three assigned quotas" for forestry. Therefore, the deadline for achieving the "three quotas" for forestry may be extended for better results. But the project must be completed this year according to the specifications laid down by the provincial party committee.

The circular also asks the departments concerned to study and come up with comments and specific proposals on how to conserve and develop the resources of Xishuangbanna.

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CSO: 5000/4057

## EXTENSIVE AFFORESTATION CREATES Milder CLIMATE, MORE RAINFALL

Lanzhou GANSU RIBAO in Chinese 14 Jun 82 p 4

[Article by He Guang [4421 0342]: "How Afforestation Has Changed Gansu's Climate"]

[Text] Can afforestation change the climate? There are many instances of improvement in the climate of some localities brought about by afforestation. The completion of the Xin'an River dam and the extension of afforestation to 39 percent of its drainage area between 1960 and 1972 have made the summers and winters milder, and there are now more frost-free days. The most spectacular change is the increase of rainfall in some areas, reaching an average annual of 100-120 mm. Linfen prefecture and Anze county in Shanxi have the most rainfall in the entire region because the afforested area has increased from the pre-Liberation coverage of 3.8 percent to 18 percent of their land area. On the other hand, there are certain localities where random deforestation has reduced the average rainfall and ushered in more arid climate. Due to a 20 percent reduction of the forested areas at Ziwuling in the north, there has been a marked decrease in the average annual rainfall in Zhengning county, Gansu.

Gansu is an inland province in the northwest far away from the sea and surrounded by mountains and plateaus not easily reached by humid oceanic airstreams, its climate has turned even more arid due to lack of forests and vegetation. As a result, the agriculture of the province is plagued by scarcity of rainfall and drought.

To what extent can large-scale afforestation increase the rainfall and improve the climate of Gansu? We know the rainfall of an area depends on the amount of moisture in the atmosphere, temperature, atmospheric circulation and topography. Afforestation can influence the temperature and the amount of moisture in the air, but has very little to do with atmospheric circulation and topography. According to estimates of meteorologists, if the sandy loess soil of the entire northwest were transformed by afforestation,

the reflection from solar radiation would decrease 9 percent. Increased evaporation would raise the amount of moisture in the atmosphere. The average atmospheric temperature in summer would drop by 0.5 degree (more so near the earth surface), the average atmospheric temperature in winter would rise slightly, and increase the average annual rainfall by 176 mm (more so in summer time). Any change of climate due to afforestation, including lower temperature, higher humidity and more rainfall, would occur in the summertime, changes would not be so noticeable during the other seasons. Moreover, the increase of rainfall due to afforestation would vary from one locality to another, much less in more humid and arid regions, more in areas where the relative humidity is within the 50 percent range. What impact would these climatic changes have on different regions in Gansu? Let us take the central arid region as an example; the average summer rainfall in that region ranges from 102.1 mm at Jintai to 222.5 mm at Yuzhong. Even though the rainfall is still far below what summer crops require and droughts are common, the relative humidity, however, is within the 50-percent range. Complete afforestation of the region would increase its summer rainfall by more than 110 mm, or 50 to 100 percent, over its original amount of rainfall, the rainfall in most parts of the region would equal or exceed that of Longdong where agriculture fares the best in Gansu.

Consequently, even though complete afforestation cannot greatly alter the climate of Gansu, it would doubtless improve its climate and reduce the threat of drought to a certain extent.

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CSO: 5000/4057

PRC SCIENTISTS REFUTE LOP NUR'S GROWING ARIDITY

OW101439 Beijing XINHUA in English 1211 GMT 10 Sep 82

[Text] Urumqi, 10 September (XINHUA)--After undertaking three expeditions to the mystic, once-thriving city of Lop Nur in northwest China's Xinjiang Autonomous region, scientists are challenging the hypothesis that the weather in central Asia is getting continually drier. According to a report of the Xinjiang Branch of the Chinese Academy of Sciences, released here today, the weather in Lop Nur does not appear to become continually drier throughout the human period of history as formerly thought.

Nearly 100 scientists presented their findings at a recent symposium sponsored by the Xinjiang Branch of the academy. "This research is of both theoretical and practical significance to the study of changes in natural environments in dry regions and the development of human history in opening up deserts," said academy branch sources.

The scientists found that Lop Nur is not a shifting lake, a position held by some foreign geographers and geologists, but is actually at the lowest point accumulating run-off in the basin. They attribute the change in the size of the water body to the rechanneling of rivers.

Their study indicates that Lop Nur is one of the world's few habitats of wild camels, now a rare animal.

Located on the eastern brink of Tarim Basin, Lop Nur was the site of a thriving ancient state--Kroraina--more than 2,000 years ago.

Academy branch sources said that international scholars have for some time been interested in the geographical and morphological changes of Lop Nur, the cause of its degeneration and the law governing the ecological change in extremely barren land.

CSO: 5000/4106



## TOURISTS' CASUAL DESTRUCTION OF NORTHERN NATURE PRESERVE ALARMS OFFICIALS

Beijing GUANGMING RIBAO in Chinese, 12 Jun 82 p 1

[Text] The Forestry Protection Division of the Ministry of Forestry produced evidence to show our reporter how seriously the world-famous Changbai Shan nature preserve has been damaged by tourists and why it is necessary to strengthen tourist administration. The Changbai Shan nature preserve located close to the northeastern border of China is a complete system and abounds in a great variety of wild animals and plants as well as tourist attractions. Last year, 40,000 tourists visited the preserve. However, due to unrestrained trampling, bathing and littering by tourists the parking lot near the hot spring has become a "dumping ground" strewn with empty cans, oil cakes, and soft drink bottles, destroying the natural community of the hot spring. The wild flowers at Butianshi have been plucked practically bare by the tourists. Unrestrained trampling by tourists have damaged the Changbai tundra, a treasure-house for studying the high altitude vegetation of the northeastern Asian continent. The parking lot at the hot spring, the arch bridge in front of the waterfall and the birch forests at Xiaotianchi are also damaged. The bedrock at several localities has become exposed due to erosion, looking very much like barren ground. As many as 65 kinds of valuable, rare and endangered species of plants have been damaged too, a setback for scientific research. Apart from the ignorance of the tourists, according to the Changbai Shan nature preserve administration, the major causes of this situation are poor administration, lack of necessary laws and regulations, and a defective administrative organization, the principal source of confusion. The Forestry Protection Division of the Ministry of Forestry believes it necessary to organize all related scientific and technical personnel to assess the impact of tourism on the natural environment of the Changbai Shan nature preserve in order to coordinate tourism and the protection of nature by means of effective measures backed up by legislation, planning and better management. All the animal and plant resources as well as natural scenic spots within the Changbai Shan nature preserve should be placed under centralized management by the Changbai Shan nature preserve administration whose approval shall be required for any other unit to operate within the zone. The management of all the tourist facilities constructed by other units in the preserve should be turned over to the Changbai Shan nature preserve administration.

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CSO: 5000/4057

ACADEMY OF SCIENCES CONVENES ENLARGED MEETING OF ENVIRONMENTAL SCIENCE COMMITTEE

Beijing HUANJING KEXUE [JOURNAL OF ENVIRONMENTAL SCIENCE] in Chinese No 3, 30 Jun 82 p 80

[Text] On 15 April 1982, the Chinese Academy of Sciences Environmental Science Committee called an enlarged meeting of committee members residing in Beijing at the time. Participants included committee chairman Li Su [2621 5685], deputy chairmen Ma Daxian [7456 1129 2009] Ma Shijun [7456 0013 7486], Guo Fang [6751 2455], committee members Wang Zunji [3769 6690 4787] Liu Qingyi [0491 7234 1355] Zhuang Yahui [8369 0068 6540] Chen Shupeng [7115 2611 1756] Li Songhua [2621 2646 5478] Hou Xueyu [0186 1331 3558] Tao Shiyan [7118 6108 6056]. Those who were invited to attend included Wang Yongsheng [3769 3057 0524] Wang Xianpu [3769 3759 3302] Sun Panshou [1327 4149 1108] Wu Wenyan [0702 2429 3601] Zhou Mingyu [0719 2494 3558] Zhou Houan [0719 0624 1344] Lin Daolin [2651 6670 3425] Huang Yinxiao [7806 6892 2556] Tan Jianan [6223 6015 1344] Teng Dexing [4910 1795 5281] etc.

During the meeting, Li Su reported briefly the condition of work in 1981 and his tentative opinions concerning the work arrangements for 1982. Since the First All Member Conference of the Environmental Science Committee held late 1980, the leadership of the scientific work has been strengthened to result in obvious progress of environmental science research at the academy. According to a preliminary statistical study of 18 research institutes [of the academy] more than 180 reports of research projects were completed in the year 1981. Among these, the intermediate experiment of the iodine-containing activated charcoal (8210 catalyst), the polychlorobenzene pollution survey, the establishment of analytical research method and standard materials, the proposal of regional noise standards of 6 types of urban functional regions, and the atlas of symptoms of plants damaged by atmospheric pollution are more valuable in terms of socioeconomic benefits and practical applications.

Important items of work in 1981:

Organization and coordination of environmental research for the region of Beijing, Tianjin, and Bohai Bay: The second Beijing, Tianjin, and Bohai Bay Environmental Science Work Conference was called. The plans and the needs

were clarified to strengthen the study of regional and comprehensive environmental problems and to formulate rules regarding compilation, writing, and abstracting reports of research results.

**Strengthening research in environmental sciences:** The research project of the Taihu Lake regional environment of South Jiangsu, its ecosystem, and classification was proposed, to be organized by the Nanjing Branch of the academy. Environmental science teams were established at the Shanghai and Changchun Branches of the academy to broaden scientific pursuits. A research plan to study the Beijing urban ecosystem was formulated. Studies on automatic monitor of environment and the information system were developed. With respect to environmental chemistry, attention was given to foreign language training of intermediate grade technicians and classes after-work for beginner grade technicians. The related institutes made selections of those to be sent to foreign countries for advance studies, work, or visits.

**Long-range plans for developing environmental science:** The Outline of Environmental Science Development Plan of the Academy in 1981-1990 (draft for the purpose of discussion) was proposed: the items and subjects of long range plans of national environmental protection science (the basic research portion) draft for the purpose of discussion) were tentatively put together.

**Exchange of results on scientific research:** From 1977 to 1980, there were 80 important projects of scientific and technological studies on environmental protection by the academy, nearly half of these results have been extended to produce benefits. The direction of the academy's environmental science information network and its responsibilities were clarified, the annual plan of environmental science information research was formulated. The conference on soil pollution chemistry was convened.

**Major items of work for 1982:** (1) Leadership of scientific research management is to be improved to strengthen scientific work, to utilize the advantage of the academy's multi-science capability, and to organize comprehensive and important environmental science research subjects for cooperative pursuit. (2) The work of organizing and coordinating comprehensive key subjects of scientific research is to continue. (3) Satisfactory assistance will be provided to evaluate environmental science research results outside the academy. Scientific research results of relatively great significance are to be given organized examination and certification.

The committee members and the invited delegates discussed the work of the environmental science committee. All agreed that in the past year a great deal of work had been performed to produce some accomplishments. The committee members suggested that the academy should strengthen its leadership regarding scientific research projects of a comprehensive and inter-science characteristic. The environmental science committee should be strengthened to take advantage of the various specialties of the academy for organizing the important scientific research jobs of environmental protection in the country.

Those in charge of the editorial department of HUANJING KEXUE delivered a report on the preparations for the scientific research report conference of environmental sciences. The plan was to convene an environmental science report conference during the second meeting of the academy's environmental science committee to be held in September of this year. This research report conference will be a review of the results of environmental science research of the academy in the past decade.

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CSO: 5000/4057

## ENVIRONMENTAL SOCIETY CONFERENCE HELD IN PEOPLE'S HALL

Beijing HUANJING BAOHU [ENVIRONMENTAL PROTECTION] in Chinese, No 3, 1982,  
p 31

[Article: "National Environmental Sciences Society Holds Spring Discussion Meeting"]

[Text] On the eve of the spring holidays of 1982, the China Environmental Sciences Society held a spring holiday discussion meeting in the West Wing of the People's Hall. A total of 95 people including renowned experts and scholars joined middle-aged and young people engaged in scientific research in environmental protection and management, educational workers and related workers to celebrate the new spring holiday together, to talk about the development of China's environmental protection work and to propose ideas on improving the environment.

The discussion meeting was presided over by Chen Xiping [7115 6007 1627], deputy director of the Environmental Office of the State Council and deputy chairman and Secretary General of the Environmental Sciences Society. Han Guang [7281 0342], director of the State Capital Construction Commission and deputy group leader of the leading group in environmental protection of the State Council, Pei Lisheng [5952 7787 3932], vice chairman of the China Science and Technology Association, Li Su [2621 5685], deputy director of the Department of Chemistry of the Chinese Academy of Sciences, attended and spoke at the meeting.

Comrade Han Guang greeted the comrades attending the discussion meeting and the comrades engaged in environmental protection work, wished them a good holiday season and talked to them on behalf of the leading group in environmental protection of the State Council and the State Capital Construction Commission. He pointed out in his talk that management of pollution must be emphasized as a major task. Today, the control of industrial pollution must be combined with comprehensive utilization. Technical improvement must be emphasized, at the same time, strong and forceful management and laws must be coordinated with efforts to solve the problem of environmental pollution.

Ma Dayou [7456 1129 3731], Zhao Zongyu [6392 1350 3603], Qu Zhongxiang [2575 0112 3276], Ma Shijun [7456 0013 7486], Liu Dongsheng [0491 2639 0581],

Tao Baokai [7118 5508 2818], Gu Kangle [7357 1660 2867], Zeng Chengkui [2582 0701 1145], Hu Hangsheng [5170 5060 0581] et al respectively expressed their opinions concerning noise, energy resources, the ecology, the environment of our national territory, city traffic, water resources, oceans, and environmental medicine.

The discussion meeting was held in a happy atmosphere.

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CSO: 5000/4057

## HEAVY METAL POLLUTION FOUND TO EXCEED U.S., JAPAN STANDARDS

Beijing HUANJING KEXUE [JOURNAL OF ENVIRONMENTAL SCIENCE] in Chinese No 3,  
30 Jun 82 pp 9-13

[Article by Yang Jurong [2799 1446 2867] et. al., of the Department of Geography Beijing Teachers University: "Soil Pollution of Heavy Metals in Sludge and an Approach to Its Control"]

[Summary] Using the sludge of the Beijing Gaobeidian Sludge Treatment Plant as the test material, a small area experiment was carried out to study the state of the heavy metal content, its change after fermentation treatment, and its dynamic distribution in soil. Results indicate that the sludge is slightly alkaline, rich with plant nutrients of N, P, K, etc, as well as high and variable contents of many types of heavy metals, among which the content of Cd has exceeded the standard of the U.S.A. and that of Hg, Cu, Pb, and As exceeded the standard of Japanese sludge. Solubility of these heavy metals is found to be in the following order:  $Cd > Cu > Zn > As > Pb > Hg$ . Most of the Cd is soluble and exchangeable and may easily be absorbed by plants. Attention must therefore, be given to its pollution of soil and crops. After fermentation, soluble Hg, Cd contents increase obviously, those of Cu, Pb slightly, and there is no obvious change in Zn. Judging from soil leaching results, almost all Hg, Cd, Cu, Pb, As ions remain in brown soil while their transferability is higher in red earth. Under the current level of heavy metal densities in the sludge and the current limitation of 10,000 jin/mu application per year, the application of sludge to soil as fertilizer and irrigation water should be limited to 20 years. Of the present heavy metal contents, pollution from Cd is the most damaging. After heavy metals enter the soil, the soil condition changes and sometimes the soil balance is destroyed; therefore, there is a need for considering the total allowance.

Beijing HUANJING KEXUE [JOURNAL OF ENVIRONMENTAL SCIENCE] in Chinese No 3,  
30 Jun 82 pp 13-18

[Article by Yang Dongzhen [2799 2639 6297] of the Central Weather Bureau Research Academy of Meteorological Sciences: "Diffusion of Fluorine Gases From the Factories Producing Phosphate Fertilizer on Hilly Lands"]

[Summary] For the purpose of providing a scientific basis for future revision of the standard of discharging harmful gases, the area of protection from the

discharge, and the treatment measures, research studies and on-site monitor tests were carried out in 1978 in 3 phosphate plants in Hunan and Fujian Provinces. Plant A is located in a highland valley in southern Hunan; Plant B in the suburb of Fuzhou, about 1600 m to the southeast of mountains of 100-200 m in height; Plant C is located in a river valley, facing the 800 m wide water surface with 100 m mountains to the rear. Computation of the diffusion data indicates that due to the action of the terrain, the diffusion parameters of the 3 plants average twice as much as that of a flat region; the P-G stability classification is suitable. The Gauss model remains suitable. In case of unorganized origin of discharge, i.e., such sources as hot wind furnace, blast furnace, sintering site, etc, where harmful gases are discharged outside of a smokestack, some methods of calculating the intensity of the discharge are preliminarily suggested.

#### BENTHIC INVERTEBRATES STUDIES TO DETERMINE DEGREE OF POLLUTION IN GUANGZHOU

Beijing HUANJING KEXUE [JOURNAL OF ENVIRONMENTAL SCIENCE] in Chinese No 3, 30 Jun 82 pp 54-57

[Article by Qi Sang [2630 2718] et. al. of the Department of Biology, Jinan University: "Preliminary Evaluation of Water Pollution at Liwan District of Guangzhou City, Using Benthic Macroinvertebrates"]

[Summary] Liwan District is under the jurisdiction of Guangzhou City, being an area of 11.8 km<sup>2</sup> in the northwestern part of the city. There are more than 500 large and small factories, including cement plants, power generating plants, steel rolling mills, electroplating, construction material, chemical, food processing plants, etc. These factories discharge harmful liquid waste about 110,000 tons a day, in addition to the 80,000 tons of sewage discharged by the inhabitants of the district. Most of the wastewater is discharged into the nearby waters without effective treatment to result in serious pollution. In July 1979 and January 1980 (representing high and low water periods respectively) surveys are taken of the large benthic invertebrates of the waters of Liuhua, Liwan, Simayong, Wukouyong lakes and ponds, etc, being all parts of the Zhujiang River system. Silt samples are taken 2-3 times at each of these points, and are cleaned and analyzed to determine the water temperature, pH, dissolved oxygen, oxygen consumption, nitrous nitrogen, nitric nitrogen, organic phosphorus, organic chlorine, petroleum, volatile phenol, cyanide, mercury, lead, copper, zinc, cadmium, and chromium contents for computing the 3-month average water pollution indices. A total of 16 species of benthic invertebrates are observed. Based upon the multi-sample indices of these benthic invertebrates, the degree of pollution of the waters is evaluated and listed in the tables. In recent years, the Shannon-Weaver species multi-sample indices have been relatively commonly used in China for pollution ecology research. This equation is found by the authors to have both advantages and shortcomings. For example, at site No 1, the H' values are below 0 in both high and low water periods, not due to pollution, however, but due to the fact that the composition of species colony of that site is different from that of other sites. At site No 11, pollution is extremely severe and living things are totally nonexistent. This fact is not reflected in the H' value and a notation is necessary to describe this fact in words. More studies are needed, therefore, to find more ideal means of expression, the paper concludes.

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CSO: 5000/4057



KASCHI-BECK DISEASE FURTHER LINKED TO LOW LEVELS OF SELENIUM IN ENVIRONMENT

Dalian HUANJING KEXUE XUEBAO [ACTA SCIENTIAE CIRCUMSTANTIAE] in Chinese Vol 2  
No 2, Jun 82 pp 91-101

[Article by Li Jiyun [2621 4949 0061] et. al., of the Northwestern Institute of Soil and Water Conservation, Chinese Academy of Sciences: "A study of Kaschi-Beck Disease Associated With Environmental Selenium in the Shaanxi Area"]

[Summary] In order to study Kaschi-Beck disease in relation to environmental selenium, the authors have collected samples of drinking water, soils, various kinds of grains, and children's hair from 130 locations in both affected and nonaffected areas according to different natural and geographical types in Shaanxi Province from 1978 to 1981, and also analyses of selenium were made in these samples. It can be seen from the results that the disease-affected areas all are of an environment where the selenium content stands very low, for example, in drinking water there are fewer than 0.2 ppb, in grains (average of wheat and corn) fewer than 10 ppb in over 95 percent of the samples examined, while in hair, which reflects Se content in the human body, there are fewer than 110 ppb in over 92 percent of 478 children. In contrast, the areas where no Kaschi-Beck disease has appeared are of an environment with low, medium and high Se content in water, soils and grains. The amount of Se provided for the children from water and grains has been calculated at 5.4  $\mu$ g or so, with the lowest daily uptake in the nonaffected areas. It can also be shown by analyzing the results of the samples in all the locations that the amount of Se in grains consists of up to 90 percent of the total amount of Se in grains and water in most locations in the areas, and it has also indicated that grains are the main Se source in these areas. But in areas where Se content in grains is low and that in water is high, Se from water may make a bigger contribution to Se in the human body, and no Kaschi-Beck disease has so far been found there.

Preventive measures have been taken by periodic oral administration of sodium selenite (Se 1 mg/week) or salts with small amounts of sodium selenite (5 mg/kg). They have proven to be effective in raising the Se content in the hair of the children in the disease-affected areas.

Dalian HUANJING KEXUE XUEBAO [ACTA SCIENTIA CIRCUMSTANTIAE] in Chinese Vol 2  
No 2, Jun 82 pp 143-149

[Article by Hu Rongmei [5170 2837 2734] et. al., of the Institute of Soil  
Science Chinese Academy of Sciences: "Study of Flourine Pollution in Soil in  
Baotou Region"]

[Summary] Fluorine pollution in the soil in the Baotou region has been  
studied and described. The distribution of soluble and total fluorine in the  
soil can in some way reflect the range and level of fluorine pollution in  
the air in that region. Atmospheric fluorine pollution in this region can  
hardly be compared with that caused by tail-ore dam, involving solid waste  
and wastewater from ore-dressing and ore-sintening plants which, according to  
data, are main sources. The accumulation rate of fluorine in soils down-  
stream of the dam is very high, sometimes over 1 ton fluorine per ha per  
meter. Fluorine pollution in soil also causes contamination of groundwater  
and vegetables, that resulted in the relocation of the neighboring production  
units several years ago. It has become clear that it is not the fluorine  
pollution, but the soil fluorine pollution intensified tail-ore dam, which  
plays its part. In view of the serious impact made by the tail-ore dam on  
the environment, practical suggestions should be advanced to take preventive  
measures for extensive protection.

9717

CSO: 5000/4057

#### BRIEFS

NPC PASSES LAW--Beijing, 24 Aug (XINHUA)--It is hereby proclaimed that the "Marine Environmental Protection Law of the People's Republic of China" is adopted by the 24th Session of the Standing Committee of the 5th National People's Congress of the People's Republic of China on 23 August 1982 and that it be enforced as of 1 March 1983. [Decree No 9 issued by the Standing Committee of the Fifth National People's Congress of the People's Republic of China] [Text] [OW240338 Beijing XINHUA Domestic Service in Chinese 0116 GMT 24 Aug 82]

CSO: 5000/4077

END